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the OIL WEEKLY

MARCH, 1955

WORLD OIL

SPECIALIZED FOR EXPLORATION, DRILLING,
PRODUCING OPERATIONS AND MANAGEMENT

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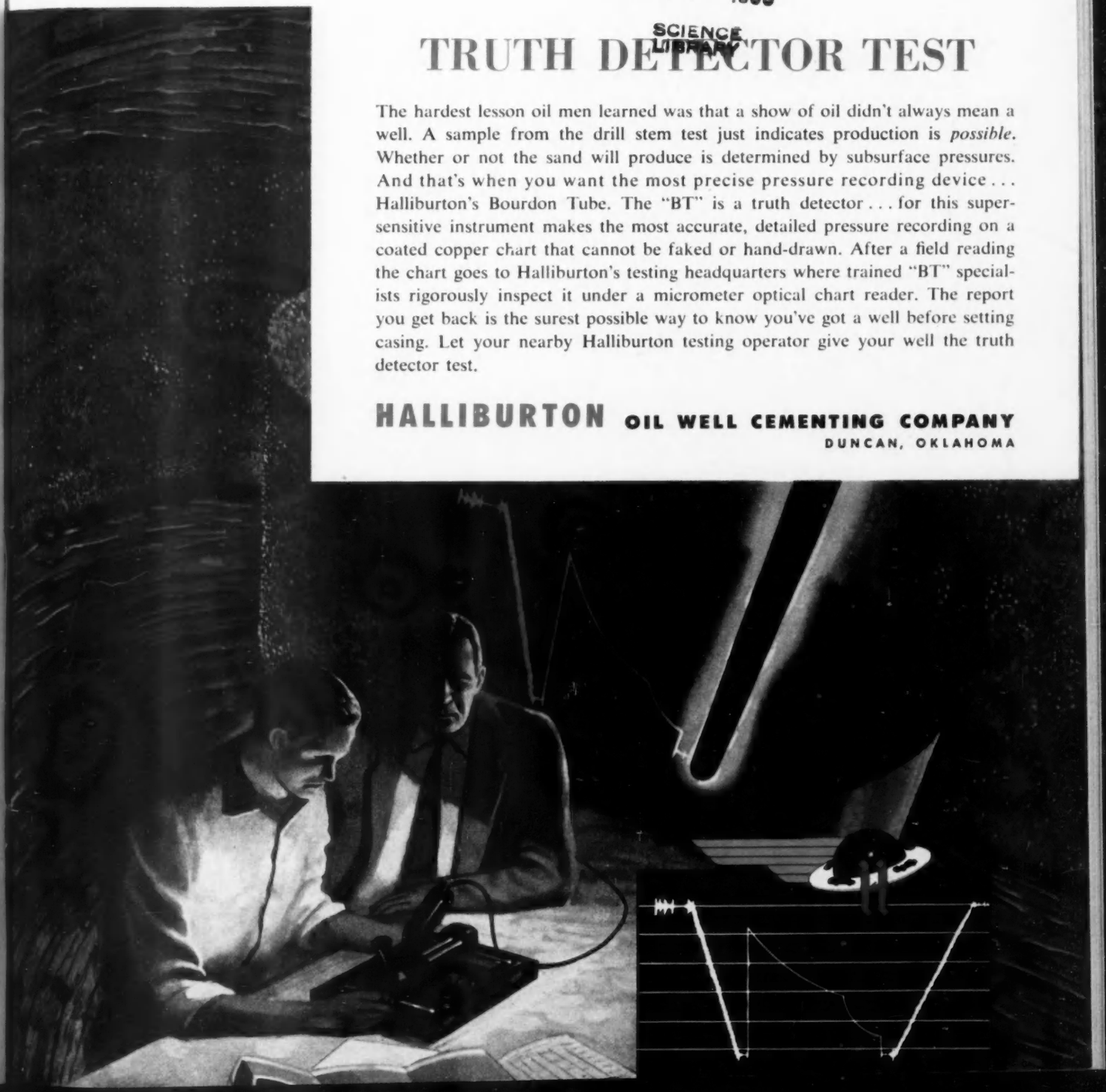

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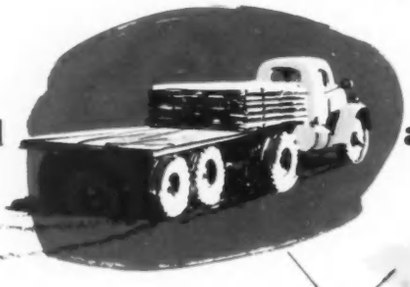

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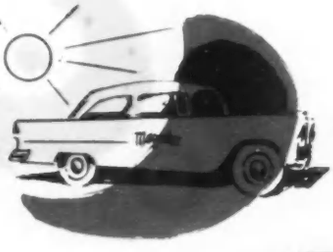

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Vol. 140, No. 4

March, 1955

WORLD OIL

Established 1916 as The OIL WEEKLY

CURRENT OUTLOOK SECTION

Looking Ahead ... 39
Publisher's Page ... *Ray L. Dudley* 41
Producers in Texas Face Stiff Competition ... *John G. Winger* 42
5000 Completions This Year in Rocky Mountain Regions? *Tom Dougherty* 44
Seven Rules of Safe Driving ... *R. J. West* 47
Joint Interest Billing Made Easier ... *A. J. Points* 49
Italian Oil Monopoly Facing Defeat ... *Staff Article* 51
How Old Is TOO OLD? ... *Irving Ladimer* 52
Changing Panorama—WORLD OIL's Views of the News ... 60
Petroleum Trends in U. S. ... *Cecil W. Smith* 70
Report from Observatory ... *Ray L. Dudley and Warren L. Baker* 72
The Month's Completions ... 74

EXPLORATION SECTION

DTA Correlates Zones Economically (Part 2) *George B. Mangold* 77
Discovery Prospects Good on Williston's East Flank *Willard D. Pye* 82
Exploratory Drilling Off to Fast Start ... *Cecil W. Smith* 95
U. S. Discoveries in January ... 96

DRILLING SECTION

Keys to Successful Competitive Drilling (Part 4) *Roy A. Bobo, Robert S. Hoch and George S. Ormsby* 113
Stub Ending Drill Collars by Pressure Weld Technique *J. L. Dickman* 117
Stub Ending Drill Collars by Electric Arc Technique *W. S. Bachman* 119
How Radioactive Well Logging Is Used in West Texas *A. J. Kerr* 134
WORLD OIL Graphics: Mud Pump Care ... 138
How to Do It—Drilling Hints ... 140

PRODUCTION SECTION

New Method Simplifies Water Injectivity Profile Logging *E. F. Egan* 149
API Tubular Goods Standards Reviewed ... *H. W. Ladd* 152
How to Prepare a Sour Brine for Subsurface Injection *Todd M. Doscher and Robert N. Tuttle* 160
Electrical Power in Kansas Water-Flood Is Economical *Frank Beach* 168
New Approach Applied to Dynamometer Studies ... *J. C. Slonneger* 174
Water-Flooding and Gas Cycling Affected by Horizontal Fractures in Thin Reservoirs (Part 7) ... *Dr. Paul B. Crawford* 182
How to Do It—Production Hints ... 186

INTERNATIONAL SECTION

Second Major Cuban Oil Discovery Is Brought In ... *Staff Article* 195
New Developments Focus Attention on Egypt ... *Don Kliewer* 196
Oil Exploration in Taiwan Facing Decisive Year ... *Leo W. Stach* 198
Inauguration Sends Giant Creole Compressor Into Action *Staff Article* 200
From Pins to Pistons ... *D. S. Curtis* 202
British Petroleum Company—a Name Change and a Rebirth *Robert E. Spann* 207
What's Happening Among World Oil Men ... 212

DEPARTMENTS

Letters ... 34
Who's Meeting Where ... 36
What's Happening Among Men in the Industry ... 216
What's Happening Among Industry Associations ... 226
What's Happening Among Service and Supply Men ... 229
Trading Post ... 248
Classified Advertising Page ... 248
Squeaks from the Bullwheel ... 250
New Books, Maps and Movies ... 264

NEW EQUIPMENT SECTION

What's New in Equipment ... 256
New Catalogs and Equipment Literature ... 262

Advertisers' Index ... 270

a quick look at WORLD OIL THIS MONTH

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following pages, checking ☑ those you want to read first.

CURRENT OUTLOOK ARTICLES

☐ **Imported petroleum** is not the only factor influencing a reduction in the number of allowable producing days in Texas. Unprorated natural gas and natural gas liquids and production from new domestic areas are important factors, too. This is pointed out in an article beginning on **Page 42. Producers in Texas Face Stiff Competition**.....**John G. Winger**

☐ **What does the future hold** for the Rocky Mountain's oil industry? Turn to **Page 44** for details on expectations, current operations and a succinct review of the region's highlights. **5000 Completions This Year In Rocky Mountain Regions?**....**Tom Dougherty**

Turn the Page ➧

THIS MONTH . . .

☐ **Money and lives can be saved** by oil industry fleet owners and individual vehicle drivers by following seven basic rules practiced by professional drivers. These rules are listed in an article starting on **Page 47. Seven Rules of Safe Driving** ..... **R. J. West**

☐ **Joint interest billing** is a difficult phase of oil industry accounting. But Ashland Oil & Refining Company has developed machine techniques which have drawn the interest of accountants for other companies. We have the details. Turn to **Page 49. Joint Interest Billing Made Easier** ..... **A. J. Points**

☐ **Oil in Italy.** Communists and leftwingers had all but closed the door to free enterprise petroleum operations in Italy, but two discoveries by private capital companies may lead to changes of great economic importance to the nation. **Italian Oil Monopoly Facing Defeat** ..... **Page 51**

☐ **Machines are valuable.** Everyone knows that and tries to maintain and get full use from them. But what about your employes—particularly the older ones? Are you discarding them at the height of their usefulness? Many companies are re-examining their mandatory retirement programs in light of proven facts that older men are capable of learning new techniques and are definitely more reliable and punctual. Experience and training are more important than physical strength and endurance, declares the author of this thought-provoking article on **Page 52. How Old Is Too Old? Irving Ladimer**

☐ **The economic outlook of the U. S.** oil industry for the remainder of 1955 depends on producing, importing and refining levels during the next few months. Substantial reductions from recent high volumes are necessary if excessive stocks are to be avoided next summer. Turn to **Page 72. Report from the Observatory** ..... **Ray L. Dudley and Warren L. Baker**

EXPLORATION ARTICLES

☐ **Differential Thermal Analysis** is a simple and accurate method of correlating formations from one well to another. It requires only the careful study of cuttings taken from wells during regular drilling operations. The analysis determines the mineral content of a sample and thereby identifies the zone from which the cuttings came. The method is relatively inexpensive as it does not involve shutdowns of drilling operations. It is positive and precise in that it minimizes the human element and individual differences in interpretation. The technique has proved practical and economical in extensive field application. See the conclusion of a two-part article on **Page 77. DTA Correlates Zones Economically** ..... **George B. Mangold**

☐ **The chances are good** for developing shallow production along the east flank of the Williston Basin. That area contains a wide variety of stratigraphic and structural-stratigraphic type traps. Factors favoring this type of oil accumulation are discussed beginning on **Page 82. Discovery Prospects Good on Williston's East Flank** ..... **Willard D. Pye**

DRILLING ARTICLES

☐ **Drilling operators** will penalize themselves if they do not use optimum bit weights and rotary speeds for each new condition. The article beginning on **Page 113,** another in a series, explains highly technical information on how to make more hole per day in simplified terms. **Keys to Successful Competitive Drilling Roy A. Bobo, Robert S. Hoch and George S. Ormsby**

☐ **Stub ending of drill collars** is being used widely in the oil fields today. On **Pages 117 and 119** are two reports giving a comprehensive review of two of the important techniques being used.
Stub Ending Drill Collars by Pressure Weld Technique ..... **J. L. Dickman**
Stub Ending Drill Collars by Electric Arc Technique ..... **W. S. Bachman**

☐ **Valuable time and more than $23,000** was saved by Carnes W. Weaver Drilling Company in drilling a 9800-foot slim hole wildcat in Chambers County, Texas. A double gin pole rig and 6¼-inch three cone bits were used. Performance was good despite small bits and inadequate pump pressure capacity. The comparison between actual and recommended practice is tabulated. Turn to **Page 126. A Deep Slim Hole in the Gulf Coast Area of Texas** ..... **Marvin Stone**

☐ **A special report** on how radioactive well logging is being used in West Central Texas shows the value of the technique which measure checks, porosity determination, and absolute definition of formations as tops and bottoms are found to be critical. The technique is recommend in other oil-producing areas where similar well conditions prevail. **Page 134. How Radioactive Well Logging Is Used in West Texas** ..... **A. J. Kerr**

PRODUCTION ARTICLES

☐ **More accurate water injectivity surveys** at less cost is the outstanding feature of the Texas Company's new method of water injectivity profile logging.

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

THIS MONTH . . .

Two streams of water—one radioactive and the other non-radioactive—are injected at a constant rate through the tubing and casing annulus. The amount injected in any section is determined by following interface and noting variation in water injected by each stream. Theory of operation, procedures, and exampes of field cases are presented in the article starting on **Page 149. New Method Simplifies Water Injectivity Profile Logging** ..... **E. F. Egan**

☐ **Here's what to expect** in the way of new provisions in the various API tubular goods standards for 1955. The latest summary of API standards was reviewed at the recent API meeting in Chicago. H. W. Ladd of Stanolind Oil and Gas Company, Tulsa, national chairman of the API Committee on Standardization of Oil Country Tubular Goods, has compiled the information presented in the article starting on **Page 152.** Also discussed are the why's and wherefore's of the weight and grade selection of oil well casing and how the various committees operate. **API Tubular Goods Standards Reviewed** ..... **H. W. Ladd**

☐ **H_2S can be removed from flood-water** by a closed system at a remarkably low treating cost. A new idea in water treating involves a stripping column. Combustion gas flows countercurrent to the flow of untreated water. Filters ahead and behind the stripping column produce a sparkling injection water at about 1 mil per barrel of water treated. Turn to **Page 160** for more details. **How to Prepare a Sour Brine for Subsurface Injection**. . **Todd M. Doscher and Robert N. Tuttle**

☐ **What does it cost to electrify a water-flood?** Cities Service Oil Company gives the answers in a 40-month analysis. Exact power requirements for the flood are broken down into individual operations. Investment costs are divided into (1) distribution lines and (2) motors and allied equipment. Power costs are analyzed on an annual basis in several ways. See **Page 168** for detailed study. **Electrical Power in Kansas Water-flood Is Economical** ..... **Frank Beach**

☐ **Pumping well problems can be solved** by a new approach in analyzing dynagraphs which involve the application of pumping well fundamentals. The father of engineering analysis of the rod pumping system, J. C. Slonneger, now chief consulting engineer for The Continental Supply Company at Dallas, shows briefly how these fundamentals can be used in a new approach in analyzing the dynagraph. For details and instructions, turn to **Page 174. New Approach Applied to Dynamometer Studies** ..... **J. C. Slonneger**

☐ **Larger well spacings** when flooding or cycling may be desirable provided horizontal fractures have been created. Flooding or cycling thin zones now may be profitable by horizontal fracturing. These are but two conclusions reached in a potentiometric model study on the conductivity of horizontally fractured thin reservoirs. See **Page 182** for the seventh in a series on horizontal fractures in thin reservoirs. **Conductivity of the Five-Spot Pattern** ..... **Dr. Paul B. Crawford**

INTERNATIONAL ARTICLES

☐ **Cuba's second major discovery** has been brought in with an expected flow of approximately 600 barrels daily. For further details on this Camaguey Province well, read . . . **Second Major Cuban Oil Discovery Is Brought In** ..... **Page 195**

☐ **And in Egypt a 2100-barrel-a-day well** has been brought in and a wildcat is scheduled to test a Western Desert area. For details on these developments, see **Page 196. New Developments Focus Attention on Egypt**..... **Don Kliewer**

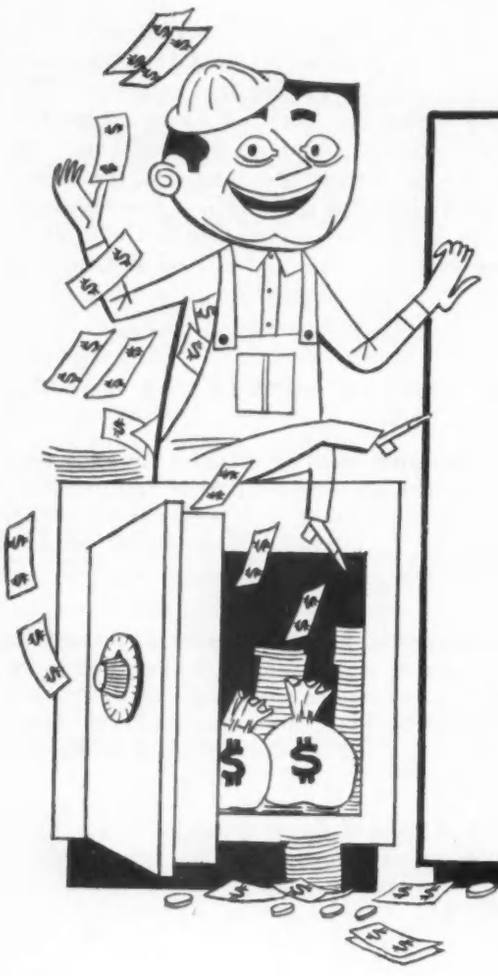
☐ **A decisive year is developing** in Taiwan's long history of oil exploration. For the latest information on a new drilling and exploration program, turn to **Page 198. Oil Exploration in Taiwan Facing a Decisive Year**..... **Leo W. Stach**

☐ **Creole Petroleum Corporation** recently inaugurated its Tia Juana Conservation Plant No. 1 in the Tia Juana district of the Coastal Bolivar fields of Lake Maracaibo in Western Venezuela. Purpose of the plant is to inject 137 Mmcf of natural gas daily into the LL-370 reservoir to maintain reservoir pressure. The compressor station is the largest of its type in the world. For pictures and a summary of the inaugural ceremonies, see . . . **Inauguration Sends Creole's Giant Compressor Into Action**..... **Page 200**

☐ **Keeping store in a remote oil field** is a chore. It strongly resembles a military operation. How Kuwait Oil Company maintains itself "in the field" is told in an article beginning on **Page 202.** It requires teamwork to keep almost 100,000 items on hand and flowing smoothly to all parts of an intricate operation. **From Pins to Pistons**..... **D. S. Curtis**

☐ **Anglo-Iranian Oil Company's** change of name to The British Petroleum Company means more than just a change in corporate name. For the significance and details on the firm, read . . . **British Petroleum Company—a Name Change and a Rebirth** **Page 207**

Next Month: The Exploration Progress Issue . . . a complete roundup of new developments and trends with special articles written by authorities in the field.



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Indexed by Industrial Arts Index and Engineering Index

Looking Ahead . . .

. . . **U. S. oil men abroad will get help** from federal tax collectors in filling out returns. Revenue Service agents will be in Canada, Mexico, Central and South America, the Caribbean area, Europe and the Far East. A pamphlet, Income Tax Guides for U. S. Citizens Abroad, is being sent out. Domestically, the tax instruction message will be spread between now and April 15 by radio, TV and newspapers. Emphasis will be on getting taxpayers to do their own figuring, rely less on agents.

. . . **A government weather-brain will aid offshore operations,** construction, many another oil operation. It's a gifted gadget capable of absorbing atmospheric information, solving complex mathematical equations, even drawing maps. Due to start producing fragmentary forecasts by mid-summer, it is expected by next year to be furnishing daily nation-wide 24- and 48-hour predictions far excelling current forecasts. Later the computer may make long-term forecasts similar to 5-day and 30-day outlooks now published by Weather Bureau.

. . . **Oil's earnings will be up** about 5 percent this year, it is estimated by Standard & Poor, investment counsellors. Earnings were spotty in 1954, it is reported, with the international companies faring best.

. . . **Oil will participate** in the first nuclear reactor project to be wholly owned and operated by private concerns. The reactor will be used only for research, with its supporting laboratory will cost $1 to $1.5 million. Participating companies will be able to look into new fields, acquire know-how, and work with atomic energy. General Electric's Francis McCune predicts that private industry's eventual development in atomic development will match the government's investment, which is $8 billion and an additional $4 billion authorized.

. . . **Texas oil lands will yield 15,700 million barrels** more by primary methods and 10,500 million more by secondary recovery, the Texas Petroleum Research Committee estimated. Known reserves in Texas were estimated at 79,600,000 barrels. The committee reported that Texas discoveries total 94,400 million barrels of which 14,800 million have been produced.

. . . **Although it generally is felt** on the West Coast that importing of natural gas into the Pacific Northwest via pipe lines from both Canada and the San Juan Basin area will hurt fuel oil markets, Standard Oil Company of California looks upon the situation as a challenge to develop and sell cheaper fuel oils. President T. S. Petersen believes that if residual fuel oils were produced with a much lower viscosity, down in the range of 1500 degrees, for example, the price might be reduced by from 10 to 15 cents per barrel and thus be attractive to users of the heavy fuels on a more competitive basis with natural gas fuel.

. . . **A new twist in products transportation** is seen in plans of Southern Pacific Company to construct a refined products line along its own right-of-way to serve cities and areas between Los Angeles and the Phoenix-Tucson area of Arizona. To be known as Southern Pacific Pipe Lines, Inc., the new subsidiary plans to use pipe sizes ranging from 8 to 16 inches; also eventually to lay a similar connecting link between El Paso and the central Arizona area. Products to be handled will consist of regular, premium and aviation gasoline and diesel and jet fuels. Construction work is scheduled to commence within 90 days.

. . . **Small oil operators** are turning more and more to radio and radar. The National Petroleum Council reports that in 1954 petroleum industry use of radio and radar increased 15.2 percent for a total of 33,857 transmitters used by 600 firms and individuals.

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'An Evil Day Is Brewing'

The important considerations involved in the U. S. Supreme Court decision in the Phillips gas case are set forth with great clarity in a few paragraphs taken from a speech by Frank Porter, president of the American Petroleum Institute.

Not only what Porter said, but the clarity with which he said it is important. When talking to non-oil men, the following paragraphs of Porter's should be a part of the armament of every oil man, whether he be executive or roughneck:

"An 'evil day' is brewing for consumers of natural gas, and for the country as a whole, as a result of the now-famous 'Phillips decision' by the U. S. Supreme Court.

"Unless Congress acts immediately to reverse this court-made law, the result will be a sharply reduced supply of gas for consumers throughout the U. S. and, eventually, a drying up of gas supplies for interstate shipment.

"The Phillips decision extends the authority of the Federal Power Commission to producers of gas in the oil fields and rules, in effect, that these producers are public utilities.

•

"Can you imagine the thousands of gas producers, who do nothing but drill for and sell gas in the field, being subjected to all the controls of a utility company? The production of gas, of course, is no more a public-utility function than the production of coal or oil, or iron or wheat, or any other commodity.

"I can think of no better means of drying up the gas supply in this country than attempting to subject the gas producers to federal utility controls.

"I know from experience, as all others in the industry know, that the producers of gas cannot exist on a 6 percent return on the investment in their producing properties, without regard to losses incident to searching for and developing gas reserves. The average chance of drilling a well which produces any quantity of oil or gas is about one in nine. In addition, these chances are not only getting greater every day, but the cost of exploration is steadily increasing.

"Those who applaud federal regulation of the producer do so under the mistaken idea that they will get a regulated low rate for gas. Nothing could be farther from the truth. It is immaterial how cheap any commodity may be if the commodity is not available for sale.

"The wellhead price of gas is only a small fraction of the price paid by domestic consumers.

•

"Please do not misunderstand me. The inability of the operator to make his gas available for interstate sale under utility controls is not a producers' strike. The results here predicted are based solely on the simple proposition that the search for, and production of, gas cannot survive under utility controls.

"It also follows, inasmuch as one-third of the gas going into interstate commerce is directly associated with the production of oil, that the country's supply of petroleum could be adversely affected.

"Federal regulation of producers' prices for gas is a long step in the direction of socialism.

"This great country of ours did not attain its world leadership in a strait-jacket of price regulation. The only assurance for a continued supply of oil and gas is the economic freedom to search for and develop new underground reserves under our traditional system of competitive enterprise. The liberty we cherish to produce and sell in a free market has given us the best way of life known."

Ray L. Dudley

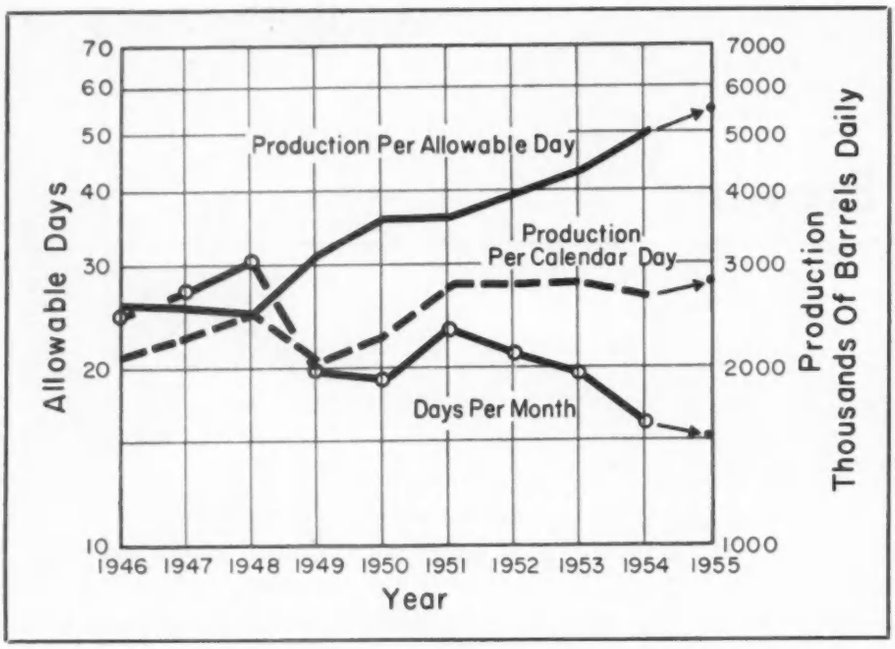


Fig. 1—Texas: Calendar Day Production vs. Allowable Days

Petroleum imports, natural gas, natural gas liquids and crude oil production mean that . . .

Producers in Texas Face Stiff Competition

By JOHN C. WINGER, Petroleum Economist,
The Chase National Bank, New York City

DESPITE THE FACT that petroleum demand in 1954 was higher than ever before, the year will not be remembered by the petroleum industry as being a great one. Oversupply, always unwelcome, was present at the beginning of the year and remained until the fourth quarter. Not one but many economic factors were responsible for the surplus. It is important that they be all recognized and placed in their proper perspective.

Abnormally mild winter weather; the downward adjustment in the over-all economy; the cumulative effect of overproduction lasting from mid-1952 until mid-1954; increasing supplies of unprorated natural gas, natural gas liquid and offshore oil; production from new domestic areas; and the continued high rate of drilling, especially development drilling, all contributed to the distress conditions of 1954.

Oversupply last year served to draw attention to the declining number of allowable producing days in Texas. Actually, the decline has been in progress for several years but did not seem to attract so much notice before. Last year, however, there were frequent public utterances regarding Texas production being restricted to only 15 or 16 days per month. And the subject was given rather widespread coverage in the press, also.

There is evidence that this publicity generated a considerable amount of apprehension and misunderstanding on the part of industry people who do not regularly follow production statistics. And it has become a matter of increasing concern also to owners of oil company securities. There has developed a rather general opinion that production in Texas has been in a continuing phase of decline. Actually, however, there has been no such decline. It is, perhaps, unfortunate that more emphasis is not placed on production per calendar day instead of allowable producing days.

Some interesting facts are revealed in Figure 1. Since World War II, there has been a downward trend in the number of allowable days in Texas, interrupted only in 1948 which action led to serious overproduction and in 1951 when demand was abnormally swelled by the Korean War and the shutdown in Iran. With an average of only 16.2 allowable days per month in Texas, the lowpoint was reached in 1954. But, during this same postwar period, the trend of production per calendar day has been generally upward.

Texas output in 1954 exceeded that in 1946 by 606,000 barrels per day—a growth rate averaging 3.2 percent per annum. The responsibility for these two divergent trends can be traced to the production per allowable day. In 1946 this allowable day output averaged 2,568,000 barrels, but by 1954 it had almost doubled, reaching an average per day of 5,052,000 barrels.

A major reason for this increase is the production coming from new wells. Annual growth in the number of well completions in Texas closely parallels the increment in output per allowable day. Economic factors responsible for the expansion of the rate of drilling are too numerous for discussion here, but one of the more important should be mentioned. Both government and industry have recognized and stated the need for a reserve of productive capacity to be drawn upon in event of a national emergency. A substantial reserve is believed to exist today, much of it in Texas. Whether or not Texas has a disproportionately large share cannot be determined until current data on the maximum efficient rates of production of the various producing states are gathered and published.

There can be little doubt that the effort to build a reserve of productive capacity, along with competitive factors, has spurred the rate of drilling—and the output per allowable day. But here we have a dilemma: obviously, the reserve cannot be maintained if, at the same time, production is at or near MER. And, if production were at MER, it would be in excess of market demand and

could not be sustained for long without serious economic disturbance.

Another factor which can be considered to have a bearing on the declining trend of allowable days in Texas is the changing pattern of U. S. production. Figure 2 illustrates the postwar production history of major oil areas. While Texas has enjoyed the greatest volumetric increment, its rate of growth has not kept pace with several other states. The Rocky Mountain area, including New Mexico, North Dakota and Nebraska, has exhibited the greatest increase. Output there advanced from 265,000 barrels per day in 1946 to 656,000 in 1954—a growth rate averaging 12 percent per annum.

Since this rate is far in excess of the 5.4 percent growth of postwar demand, there is increasing competition for markets. In 1946 the Rocky Mountain region supplied only 5.6 percent of the U. S. production, but by 1954 following discovery of new production and completion of pipe line outlets to eastern markets, it was accounting for 10.3 percent.

As the drill continues to find and develop production in new regions, the oil will seek a market and there will be an impact upon established producing states. The degree of such competition will depend primarily upon the proximity of markets to the new production.

Outlook for demand in 1955 is good and domestic production of crude is expected to average about 360,000 barrels per day above the 1954 rate. If Texas should furnish the same proportion as it did in 1954, its output would average 2,841,000 barrels per day. That would represent an increase of 152,000 barrels per day—5.7 percent—over 1954.

But, despite this substantial boost in actual production, the number of allowable producing days seems likely to be reduced. On the basis of recent trends and the continuing rate of drilling, it is estimated that an average of 15.5 allowable days per month will provide calendar day production averaging 2,841,000 barrels. And unless there should be unforeseen influences from new factors, these two divergent trends as shown in Figure 1 can be expected to continue.

—The End

About the Author

JOHN G. WINGER "grew up" in the petroleum industry having been introduced to it at an early age through his family's bulk plant in North Dakota. After graduation from the University of North Dakota and a hitch in the Navy in World War II, Winger joined Cities Service in New York as an economist in 1946. Four years later Dr. Joseph E. Pogue took him into the Petroleum department of the Chase National Bank of the City of New York, where he is now petroleum economist. Through his close studies of the industry's economics, Winger has become a recognized authority in the field and is a frequent speaker before industry groups and associations.

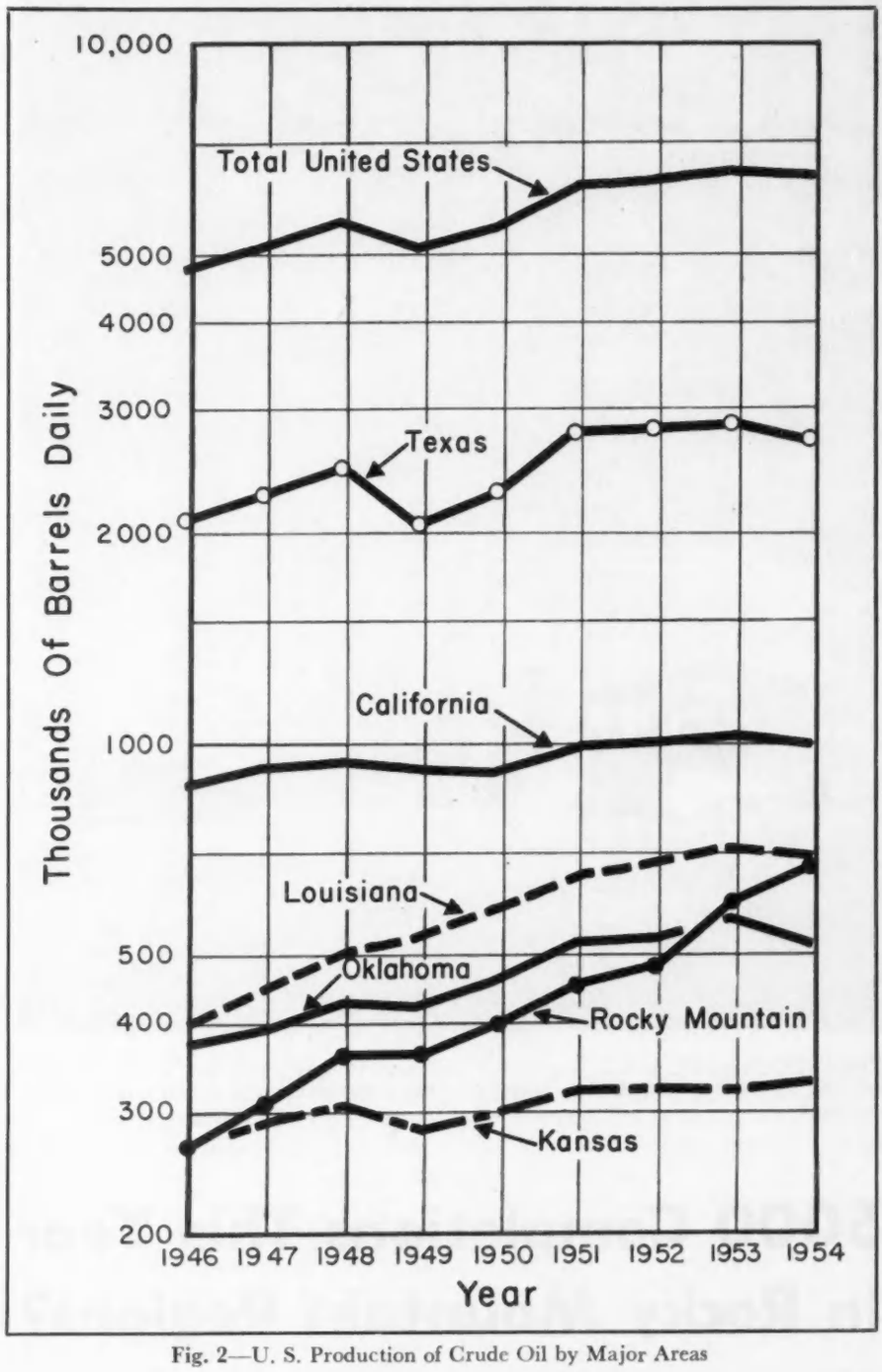
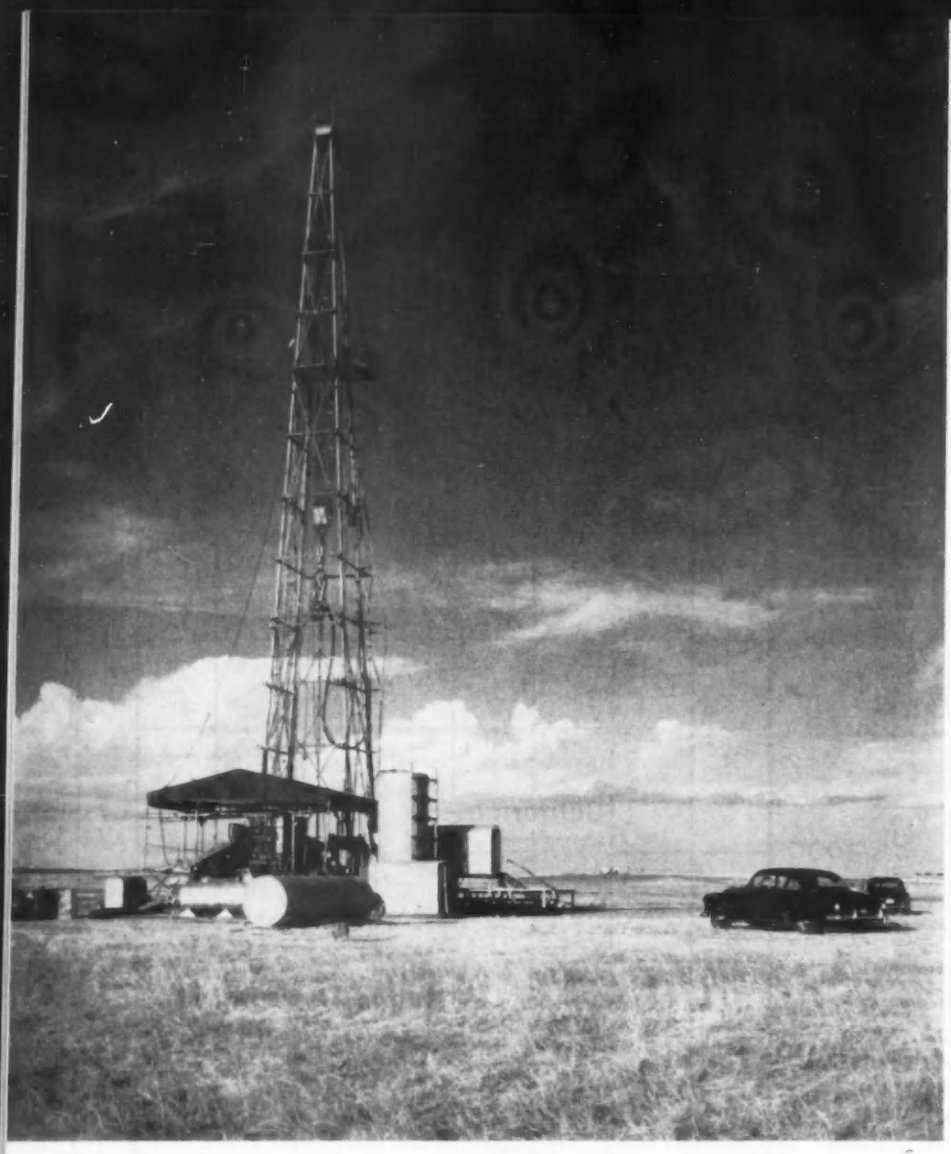


Fig. 2—U. S. Production of Crude Oil by Major Areas



THIS SUCCESSFUL WELL was drilled in Logan County, Colorado, and is a typical location in the Denver Julesburg basin, now the most active area in the Rocky Mountain area.

5000 Completions This Year In Rocky Mountain Regions?

With building of pipe lines to major market outlets, states in this area may set a pace that will see 1954's crude yield of 500,000 bpd surpassed.

By TOM DOUGHERTY

OIL PRODUCERS in the Rocky Mountain states anxiously sought limited pipe line capacity not so long ago to move their oil to market. Today only a few localized areas of the region suffer for lack of transportation to major crude markets.

Drilling which accompanied construction of the first new pipe line outlet for the Rockies justified the initial project and demonstrated the need for even more lines. As pipe lines were completed, the region took its place as one of the most dynamic areas of exploration in the oil industry.

Exploration success has justified operators who have moved to the Rockies since the end of World War II. With a place in the competitive market assured, the region can maintain the pace of exploration and development which has advanced the status of the Rockies in the past several years.

Measured in terms of well completions alone, growth of the Rocky Mountain oil industry is significant. In 1949 only 1012 wells were completed in the entire region. Last year the total was 4203 wells and more than 22 million feet of hole.

But the number of wells drilled in the producing history of the Rockies is not large enough to be decisive for more than a small portion of the region.

What has happened is that enough drilling has been done to broaden the area of expected success. Enough has been done to show what can be done.

The Rocky Mountain region for the first time is in a position to enjoy a degree of growth in keeping with the results of work done to date.

Future bright. The era of greatest activity is still ahead in the Rockies. From the official beginning of the oil business in the Rockies at Florence, Colo., in 1862, to about 1922, Rocky Mountain oil was a lusty and growing business. By rail and water, crude and products from the region made their way all over the world. Then the bottom fell out. Big fields in the Mid-Continent and elsewhere were discovered. Oil from the Rockies paid too much for its tickets to market. For more than 20 years, an economic damper lay heavily on the region's oil. Drilling and production were limited.

It was not until the need for more oil brought on by World War II was felt that exploration was renewed in the Rocky Mountain states. Even by the end of the war, not enough Rocky Mountain crude could go to market in competition. Rangely field, in Colorado, a 65,000-barrel-per-day producer was discovered in 1934, but was not developed until 1945 and 1946.

Attention paid the Rocky Mountain region in wartime and demand for

production during the war paid off when the war ended. There was a surplus of production over regional needs of the Rockies.

By 1950 plans to supplement the one 60,000-barrel-a-day pipe line out of the region were being discussed. Early in 1951 a group of five major companies announced that the Platte pipe line from Wyoming to Wood River, Ill., with an initial capacity of 100,000 barrels per day would be built.

When the line was proposed, some doubted it could find the necessary 100,000 barrels per day above regional needs to keep it filled. This observation reckoned without the immediate increase in drilling which followed announcement of the line.

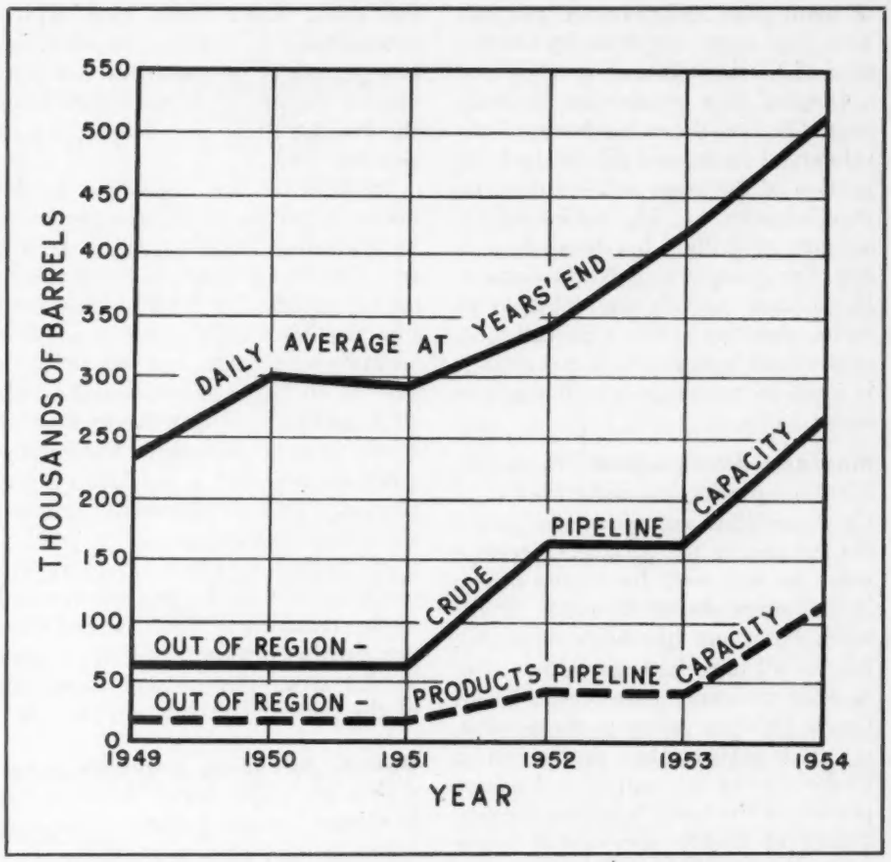
In the meantime, in 1949, oil had been discovered in the eastern portion of the Denver Julesburg Basin, and development began in western Nebraska and northeastern Colorado. This basin, site of the region's oldest commercial oil well, was to become the greatest single attraction for independent operators in the region.

Also, in 1951, oil was discovered in the Williston Basin. The North Dakota discovery was immediately followed by others in Montana. And the Williston Basin became one of the most highly-publicized of modern oil provinces.

Wyoming, oldest major producer in the region, led in development of new production during this time, however. Construction of the Platte pipe line was largely predicated on Wyoming reserves. The line later was expanded on the basis of Denver Julesburg developments, as well as new productive capacity in Wyoming.

By 1954, the Denver Julesburg had assumed the lead among Rocky Mountain provinces in terms of activity. Colorado led the states of the region in total drilling. New and sizable fields had been established in the basin, and a healthy discovery list continued to grow week by week.

Consequently, in 1954 Sinclair Oil & Gas Company and The Pure Oil Company built an 80,000-barrel-a-day line from Merino, Colo., to facilities in eastern Kansas. At the same time, Service Pipe Line Company formed Western Pipeline Company to build a line from existing Service facilities at Fort Laramie, Wyo., across western Nebraska northeastern Colorado, and into and through Kansas. This line has an eventual capacity of 160,000 barrels daily.



Rocky Mountain Crude Production 1949-54

Meanwhile, the North Dakota portion of the Williston Basin had acquired outlet for production in the form of a 30,000-barrel-a-day refinery at Mandan, and line to supply it from the fields in the western part of the state.

This left only eastern Montana and northeastern Wyoming as producing areas of promise with no adequate outlet. Early in 1955 a joint project by Shell Oil Company and the Murphy Corporation proposed a pipe line this year from eastern Montana to Fort Laramie and Guernsey, Wyo., to tie into the Western pipe line and/or the Platte Pipe Line Company's Casper, Wyo.,-Wood River, Ill., pipe line. When construction of this line is complete, the last desperately needed outlet for substantial producing areas in the Rockies will be in operation.

From a province with promise but no market the Rockies has become a province with expanded promise and adequate outlet to market.

Geophysical activity. During the past six years, the period of heaviest development of the Rockies, the region has employed about a third of all the nation's geophysical crews. One of the largest land plays in the history of the industry has been steadily in progress. The number of rotary rigs has topped 300 only for brief periods, but they have stayed steadily at work for the most part.

More than 200 million acres is estimated under lease in the Rockies. Majority of this acreage is federal, since the majority of federal lands is within the region. A large amount of Indian, railroad, state and fee land is also leased. But, by comparison with older areas, the area is not heavily leased. The relative ease of acquiring land for exploration remains one of the biggest attractions of the Rockies.

The new producing states of the past several years are Rocky Mountain states—North Dakota, South Dakota, Arizona, Nevada have all been listed as producers since 1951.

State by state and in one geologic province after another, activity of the past several years has pointed the way to additional activity.

In the Williston Basin, development along the Nesson anticline in western North Dakota has established present production, under definite proration

of more than 30,000 barrels per day. This has been the most rewarding area of North Dakota.

Despite some production in Bottineau County, there has been no development on the east side of the U. S. portion of the basin to rival those on the Canadian east side. A considerable amount of drilling has been done in east side prospects in North Dakota. Hugh lease spreads are still held by many operators in this area and more exploration is expected. Total drilling is small in comparison with the area under study.

Montana development. In eastern Montana production along the Cedar Creek anticline and north of it in the Poplar area is the principal development. Several wells have been drilled in the northeastern corner of the state, but none has been successful. Almost all have had shows, however. A 1954 discovery east of the Cedar Creek anticline points to the possibility of stratigraphic production in Ordovician in the central and deeper portion of the basin, implying the possibility of highly successful future work.

Generally, cold weather drilling problems and peculiar drilling and production problems of the basin are solved or well on the way to solution. The area needed crude outlet to relieve the possibility of success at high cost in deep basin drilling with no prospect of market. As already noted, the needed outlet is about to become a reality. An increase in both exploratory and development drilling should result. At the present time about 30,000 barrels of production per day is available in eastern Montana. This has been developed with a comparative minimum of work.

Interest created by Williston Basin prospects has spread west and north in Montana, with considerable development in the Northwest Sumatra area of Rosebud County, a determined exploratory program through the northcentral part of the state, and important shows in Glacier County, in the northwest central area. These latter shows are in the disturbed belt fronting the Rockies through the state. The area has long been regarded as one of considerable geologic promise.

Wyoming reserves increased. In Wyoming discoveries along the southwest flank of the Powder River Basin, continued development of the Big Horn Basin, and additional drilling in the Wind River Basin have added substantially to reserves. In addition, two periods of development in northeastern Wyoming on the east side of the Powder River have taken place in postwar years.

In 1952 oil was discovered in the northern portion of the Powder River in Wyoming. Development in this area, Sheridan County, has been steady but not spectacular. Interest has spread into the Montana portion of this basin, where there was no previous success. In 1954 gas was found at relatively shallow depths in Powder River County, Montana. Present indications are that a considerable exploratory and development program will follow this discovery.

An apparently major discovery was made in 1954 in the southeastern end of the Wind River Basin west of Casper. Further drilling is still in progress in this area, with no real assessment of the potential production possible.

Denver Julesburg gateway. Gateway to the entire region, however has been the Denver Julesburg Basin in Colorado and western Nebraska. Production was found in the Gurley field, Cheyenne County, Nebraska in 1949. In that year only 39 wells were drilled in the basin. By 1954, the basin had 1738 of the region's total of 4203 completed wells.

While the early lease play following initial discoveries in this basin saw a lot of acreage leased by major companies, independents were also highly active. Drilling brought relatively small discoveries, with a few scattered good fields.

A pattern of farmouts and support drilling by independents developed. Fast, easy, relatively cheap drilling in this basin brought smaller operators to the area.

A well can be drilled in 7 to 10 days, using about a bit per day to tap Cretaceous production at 3500 to 7500 feet. A producer, with equipment and casing, will cost $40,000 to $50,000.

With the discovery in 1952 of Little Beaver-Badger Creek in the southern portion of the Denver Julesburg trend, thinking on the Denver Julesburg changed somewhat. The field soon became the second largest in Colorado, with production of more than 10,000 barrels per day.

Adena field, Morgan County, was discovered in 1953. This field produced 16,000 barrels a day by the end of 1954. It also helped to prove that good fields with substantial reserves existed in the basin.

In 1953 production was found in the deeper Lyons (Permian) sand on the west side of the basin. This was the first pre-Cretaceous production. The discovery added a new dimension to the basin. Later drilling to this horizon has not been particularly successful, but no area can now be condemned without consideration of deeper possibilities.

Nebraska trend developed. With development in western Nebraska, a producing trend from Kimball and Cheyenne Counties to Adams and Washington Counties in Colorado has been created. Discoveries south, in Elbert County, west in Jefferson County along the mountain front, and east in Washington County late in 1954 and early 1955 added much new territory to be explored in this basin. Movement east and south of existing production, further exploration of the disturbed area along the mountains on the west side, plus continued pre-Cretaceous drilling are certain developments for this basin this year.

In addition to the Denver Julesburg Basin, other eastern Colorado developments included extension of Greenwood gas field production from Kansas into southeastern Colorado and the beginning of an exploratory program in the non-productive Raton Basin of southern Colorado and north-New Mexico.

The areas already discussed are east of the Continental Divide. The area to the west begins with the San Juan Basin in New Mexico, which, while not west of the Divide, is allied now to that part of the region. San Juan enjoyed a large gas development from the end of the war to the present time. In 1952 a pipe line from this area through Utah and western Colorado to the Pacific Northwest was proposed to supply gas to the Pacific Northwest states, the only major area of the nation without natural gas service.

After long negotiation the line will apparently be built. The original plan has been modified to tie in San Juan and western Rocky Mountain gas to the San Francisco area and to allow access of Canadian gas to the system.

Route of this system lies through an area long regarded as a highly prospective gas producing province, but which has had no previous outlet. Gas discoveries in western Colorado,

Continued on Page 48

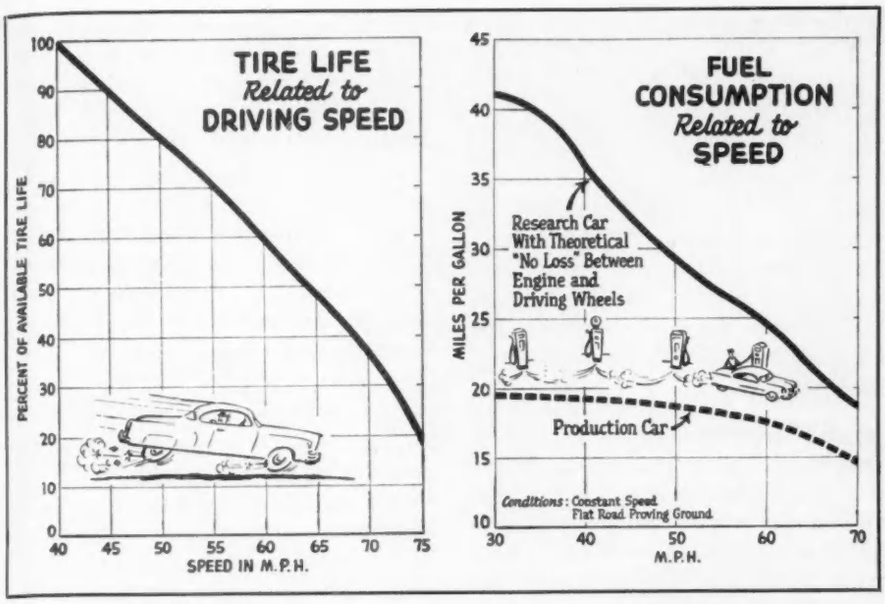


FIGURE 1

FIGURE 2

Oil industry fleet owners and individual drivers can save lives and money by following these . . .

7 Rules of Safe Driving

By R. J. WEST, Safety Director,
Mid-Continent Supply Company, Fort Worth

CUTTING FLEET OPERATING cost involves positive steps towards accident prevention. Reducing fuel consumption and minimizing tire wear require a reduction in speed which leads to fewer mechanical adjustments. Easy starts and stops also are directly related to a measurable reduction in accidents.

Figure 1 illustrates the increase in percentage of tire life attainable at lower speeds. It provides sufficient reasons for steps to be taken to reduce road speeds to planned limits.

Excessive fuel. Excessive fuel consumption is also indicative of unnecessary expenses resulting from high speeds, faulty driving habits or poor maintenance. As fuel consumption is reduced by bringing car speeds down to legal limits or lower, the accident curve comes down in even greater proportion. The fuel consumption chart clearly demonstrates that greater fuel economies are realized at the more reasonable speeds. Here again is sufficient reason to reduce road speeds to planned limits.

Professional driving is the key to accident-free driving and improving operational economy. Professional driving methods are the result of two factors:

(1) Trial and error and
(2) Method analysis.

Guarded skills. Over the years, some individuals develop driving skills which are as jealously guarded by the individual as a skilled craftsman guards his technique. Proper planning of a pass, figuring the other driver will always do something wrong, how to shift gears without clashing, proper use of gears for downhill braking in order to require a minimum assist from brakes, how to approach a blind intersection in the city or country, or a traffic light that might turn red, how to keep an area of defense on all sides of you, how to tell when and where not to pass at night, preventive driving for any situation. These are the prized hallmarks of the men who drive for a living.

Analyzed methods are the results of:

- Specific study by traffic and safety engineers of particular driving situations.
- The development from these studies with the help of professional drivers of standardized driving methods to eliminate or reduce each driving hazard. These results are slowly finding their way into public driving habits and attitudes.

Habits and attitudes. Safe driving is a matter of habits and attitudes of the individual, therefore, for full effectiveness he must be contacted, instructed, motivated, and coached as an individual. Many persons believe they are expert drivers, so in order to determine best how an individual actually drives one must ride with him and observe his driving habits and attitudes.

The difficult task—and the one one managers must face directly if they are to obtain the full benefit from a cost reducing accident prevention program—is to acquire the know-how of translating their finding into improved driver practices. Success is the continuous and systematic application of corrective measures based upon needs found by regular checking of drivers.

The problem is the same as teaching employes how to perform other jobs in accordance with approved and tested methods. Each manager or supervisor personally should learn how to perform the "pro" driving practices and honestly strive to practice professional driving as an example to all other employes.

Professional driving. A few professional driving practices which should be taught by managers are:

- **Speed within conditions, even on race tracks.** Take into consideration at all times the condition under which driving is done—the hills, hollows, traffic, weather, road surfaces, and drive accord-

ingly. If one must speed, it should be done on an authorized speedway and not on the highway.

- **Keep an area of defense.** Drive on the defensive at all times, never expect the other driver to do the right thing. Don't expect them to stop at a red light or stop sign, but you be prepared to do so. Defend against the negligent acts of others.

- **Approaching a blind intersection, or signal light in the city or country.** Always expect someone to come out of a blind intersection, or run a stop sign, or red light—they do it and it causes many bad accidents.

- **How to pass a vehicle on the highway.** Always drive at a safe distance back of the car or truck immediately ahead. That way the road is visible for a long distance ahead and, when an opening is about to occur, you can gain momentum, using space between yourself and the other car. You will avoid continuously "sticking your nose out" until somebody hits it. Stay behind a minimum of ten car lengths at 50 m.p.h.

- **Use the proper lane (the right hand lane—the "expert" lane).** Always drive in the right hand lane even though the highway or street is not striped. Always signal when changing lanes, giving the other driver plenty of time to give clearance. Make a right turn always from the right lane. Always enter the right hand lane after completing the turn. The same is true when turning left, always make the left turn from the left hand lane and, on completing it, enter the left lane.

- **Signaling.** Always let the other driver know what you are going to do by giving the proper signal.

- **Be a smooth driver.** Avoid jack rabbit starts and stops, constant speeding up and slowing down. Know that you have full control of your vehicle at all times for any situation. —**The End**

Rocky Mountains

Continued from Page 46

made as long as 25 years ago are still shut in. Southwestern Wyoming's Green River Basin has fields of considerable age, but with little development of gas. Utah's possibilities have been proven with developments such as Clear Creek in Carbon County. The western slope of Colorado has had numerous discoveries in the past three years.

Large Programs. Economic pressures which led to development on the east side of the Rockies when market outlet came are on the verge of providing a very large exploratory and development program on the west side of the Divide.

Recent development in Utah's Uinta Basin has been steady but not spectacular. Deep, difficult drilling, high pour-point oil, and rugged terrain have contributed to the relatively slow but steady pace of work in this basin.

Some time ago, large lease investments were made in the Paradox Basin of southeastern Utah by a large number of major companies. In 1954 Shell found the first commercial production in this highly promising basin, and is proceeding with development. Shell also found marginal gas production in northeastern Arizona to provide that state's first production.

During 1954 Shell found the first oil production in Nevada, in a Nye County wildcat south of Ely. A major leasing program followed, adding to already heavy holdings in Nevada by several companies. This play also affected the portion of the Basin and Range Province in western Utah.

Further drilling in Nevada has been light, has not yet been successful.

Assuming stable national conditions during 1955, outlook for the Rocky Mountain oil industry is optimistic. Production is expected to climb above the 500,000-barrel-per-day figure of 1954.

A total of 5000 completed wells for 25 million feet of hole would not be surprising in 1955.

Summaries by area. Area by area outlook summaries bear out the general prediction. The Denver Julesburg Basin will set the pace for the region again in 1955. Between 1500 and 2000 wells should be completed in this basin. Major developments are possible on the west side, to the south, and in the northwestern basin area in Wyoming where little work has been done.

In Wyoming increased interest in the Wind River Basin, plus attention to gas possibilities of the Green River Basin will add to the backbone area of the state . . . the Powder River and Big Horn Basins. Northeastern Wyoming will benefit by new pipe line outlet.

Eastern Montana activity will show an increase. Development drilling should rise on the strength of new outlet. In the Glacier County area, additional wildcatting will continue, with amount of work done dependent on success there. State land situation in Montana is bad, with leases only for limited term—a hindering factor.

In North Dakota continued development along the Nesson anticline will be supplemented with exploration in the southwestern corner of the state. A considerable drilling program toward the east side of the basin will jog along at a steady rate, unless a substantial discovery is made there.

Although there is now production only in Harding County in the northwestern corner of South Dakota, a large leasing program has been under way in 1954 farther east, and additional wildcatting will result.

A desultory exploration program for the Raton Basin both in Colorado and New Mexico is expected.

The San Juan Basin, both in Colorado and New Mexico, will have vastly increased activity when construction of the Pacific Northwest Pipeline Company's pipe line system starts this spring. The same comment may be applied to western Colorado and to the Green River Basin in Wyoming.

In 1955 some of the first long strides should be taken in the Rockies' oil and gas development.

Added to the other concerns of the oil industry in the past few years has been the possibility of greater utilization of atomic energy. The Rocky Mountain region now is the principal supplier of atomic ores. Many oil operators have become interested in this source of energy. The operator in the Rockies has an opportunity to implement that interest in addition to his regular interest, for he's at work in the energy resources heartland of the nation. —**The End**

Fig. 1—Joint interest billing is handled on two typewriter-bookkeeping machines.

Joint Interest Billing Made Easier

Ashland Oil & Refining Company's machine techniques for handling joint interest billing for crude oil producers have drawn interest of other companies.

By A. J. POINTS, Controller,
Ashland Oil & Refining Company, Ashland, Ky.

JOINT INTEREST billing is a thorny phase of oil industry accounting. But Ashland Oil & Refining Company, Ashland, Ky., a major inland waterway crude and crude products transporter, has mechanized the procedure. To such an extent, in fact, that accountants from other companies often visit the Ashland firm to review its machine techniques for handling joint interest billing for crude oil producers.

Since joint interest billing in an integrated company is a minor bookkeeping function in relation to recording trade accounts receivable, for example, many such companies have retained handwritten records.

Pen and ink. Ashland formerly used a set of ledger sheets for each lease, with columns extending across for operating expense, intangible drilling expense, equipment cost, etc., and one column for charges to joint interest owners.

As each invoice was paid, a copy was coded by lease and account number for the company's share, but the share allocable to joint interest owners was coded to suspense by the Production-Accounting section. Invoice copies were sorted alphabetically and by account number, and posted to a handwritten control. The suspense account was cleared at the end of each month when other interest holders were invoiced for accumulated charges in that account.

Full detail from each invoice, including description of every item, was written into lease ledgers—a time-consuming job at best. This was continued throughout the month.

At month-end, each ledger sheet was cross-added, down-added and the total of all was proved to the control. All errors were checked out at this time.

Distribution by joint interest owners was filled in by hand. Then each ledger was typed on a stencil for a spirit duplicator. All stencils had to be proof-read. Finally, they were printed, sorted and mailed. Three copies were sent to each joint owner.

This system demanded considerable repetitive work. Errors were frequent. A peak load had to be handled at the end of each monthly period. Sending statements out was nothing less than an appalling task.

Machine method. Invoices are still coded when paid, by lease number and account number but at 100 per cent instead of for Ashland's interest. Accounting machine operators sort invoices by account (Direct Lifting Expense, Intangible Development Cost, Lease Equipment, Dry Hole Expense, Abandonment Expense), and then by

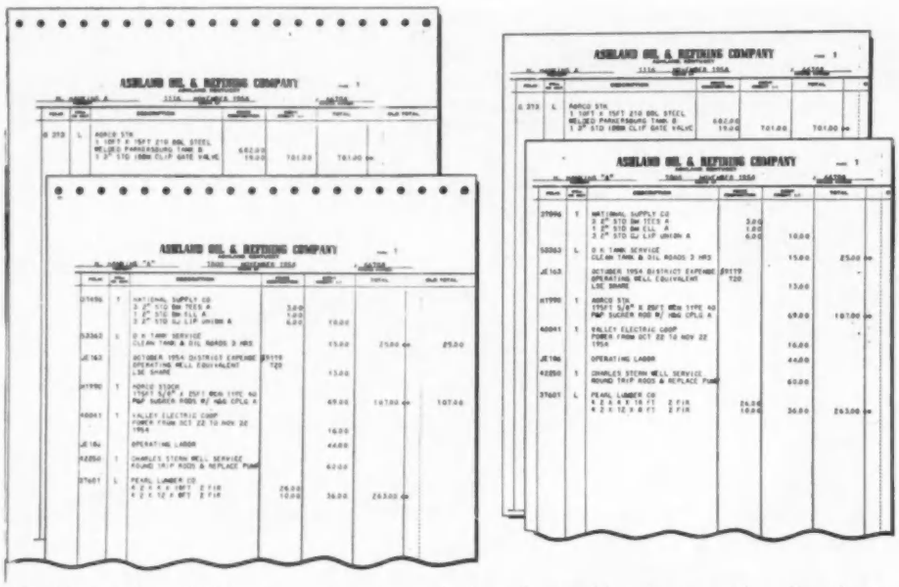


Fig. 2—Posting of joint interest expenses is done by bookkeeping machine directly to duplicating stencils which act as ledger cards throughout the month. At month-end, several copies are duplicated for each interest owner, as shown at right.

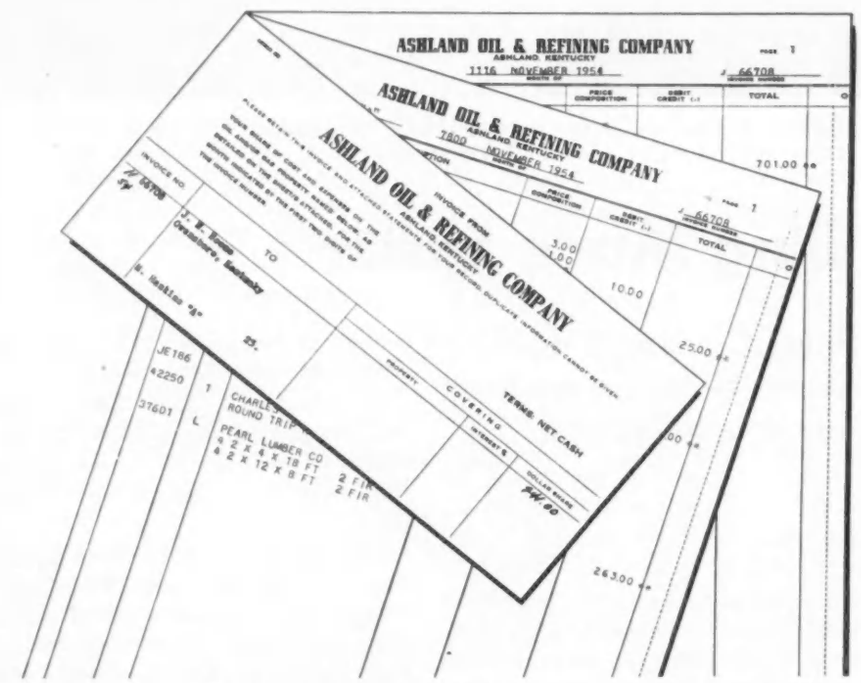


Fig. 3—This is the assembly of forms immediately prior to mailing to a joint owner.

lease within that account. They are then adding machine taped, by account.

Actual posting is done on two typewriter-bookkeeping machines, directly to duplicating stencils (See Figure 1), which replaced handwritten ledgers. Bookkeeping machines automatically compute and print the balance to date, each time a posting is made. At the same time, posted amounts accumulate in a separate total.

Stencils (ledger cards) are filed by account and by lease within that account, and are, of course, posted in the same order. That is, all Direct Lifting Expense is posted daily to the stencil, and the machine total is proved against the adding machine tape for Direct Lifting Expense. Then all Intangible Development Cost is posted and proved—and so on. In each case, after posting, the total is entered by machine to an over-all control for that account.

There is a machine proof of old balance "pickups," obtained as part of the posting operation. Thus, all figures are in balance at all times and all accounts are up to date.

As a matter of good practice, a trial balance is taken at the end of the monthly period, but there is never any difficulty in proving. The ledger cards—duplicating stencils—are now used to run off three copies for each joint owner (similar to the copy shown in Figure 2). The joint owner receives three copies of a statement reproduced from the ledger card for each account affected in his lease; in the illustration shown, two accounts, 1116 and 7800, were affected.

As a by-product of the duplicating operation, asset accounts are printed (from ledger cards for Intangible Development Cost and Lease Equipment). This, too, formerly was a separate, handwritten job.

A "billing master" for each lease is prepared by addressing name and address on another duplicating stencil. Total amounts for Intangibles, Equipment, Dry Holes, Lifting Expense or other accounts are entered at the top of this form; dollar share is entered at the right of each name. (The interest percentage is printed as part of the addressing operation.)

From this stencil, copies are made for each joint owner. The same stencil prints the information on "analyslips" which are used for showing the address through a window envelope after they have been stapled to the detailed invoice.

Figure 3 shows the assembly of forms as they are just before being mailed to a joint owner.

Improvement in operation. Ashland currently has about 1100 joint owners of 321 leases. There are about 20,000 postings a month.

Ashland's Production Accounting section handles not only joint interest billing, but also all accounting work in connection with exploration and oil producing operations. At the time Ashland installed the machine system, volume was about half what it is currently and an average of two girls and six men were assigned to the department. Now, there are two women and five men in the department. Personnel reduction has been due largely to adoption of this machine bookkeeping system.

Under pen and ink methods, statements usually were mailed about five weeks after the end of the month. They are mailed now on the 21st or 22nd prior to the end of the following month. **—The End**

Italian Oil Monopoly Facing Defeat

Two major discoveries may lead to the overthrow of the Communist-supported setup.

ITALY MAY BE on the brink of important development of its domestic petroleum potential if the government can agree on a liberalized petroleum law that would make exploration and production attractive to private capital. The "if" is a big one in a country where influential communists and other left wing groups strongly oppose any change in the present unfruitful, near monopoly enjoyed by a state firm.

Two significant discoveries—one in Sicily in 1954 and the other in February on the Italian mainland near the Adriatic coast, both of which were made by private capital firms—have revived the hopes of advocates for competition in Italian oil development. So far the operating results of the government company, Ente Nazionale Idrocarburi, which dates back to Mussolini's times through a predecessor company and which under a 1951 law was given exclusive exploration and development rights in the 18,000-square-mile Po Valley of Northern Italy, have been numerous gas discoveries but no new sources of oil.

The gas, some of which was discovered by private capital companies that are permitted to maintain the status quo on their existing concessions in the valley, is distributed to nearly all industrial centers in Italy, but the monopoly company has to depend on extremely high taxes on imported petroleum to keep its domestic-produced gas competitive in price. Lack of funds, initiative and technical know-how are responsible for ENI's rather mediocre showing.

Success in Sicily. Italy has produced oil since 1861, but the peak production reached in 1953 only amounted to about 1800 barrels daily. There was a decline to just under 1500 barrels per day in 1954, but the start of commercial production in Sicily at the end of 1954 indicates that 1955 production will at least double the last year's volume, probably averaging around 3300 barrels daily for the full year. Even at this rate, the nation's domestic crude output only amounts to 1 percent of domestic demand which averages about 210,000 barrels daily. The bulk of the supply is filled with Middle East imports. This is a big factor in the nation's unfavorable foreign trade balance.

Fortunately Sicily, a near autonomous Italian region, has a separate oil law and has opened petroleum operations to private capital—including foreign—on favorable terms since 1950. Gulf Oil Corporation's subsidiary, American International Fuel and Petroleum Company, obtained the first concession under the postwar law and a major discovery was made early last year at Ragusa in the southern part of the Island. The Ragusa field, with four wells completed, is on commercial production and each well pumps 500 to 600 barrels daily of heavy (19 to 21 gravity) crude. The crude is being refined at the nearby Augusta refinery of Raffinerie Siciliane Olii Minerali. Production is from a thick limestone formation, topped at about 6200 feet.

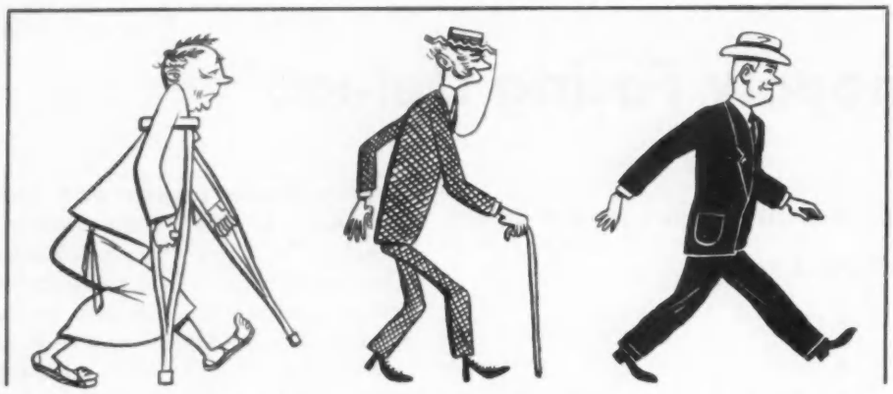
The discovery led to a flurry of concession activity in Sicily and by the start of 1955, 24 exploration permits, totaling 1,950,000 acres, had been granted to Italian companies and nine permits, comprising 605,000 acres, are held by foreign companies. A subsidiary of British Petroleum Company also made a discovery of very heavy crude near Vittoria, west of Ragusa, last year and is continuing exploration. American International plans 20 additional wells at Ragusa and Mediterranean Oil Company, owned 65 percent by Gulf and 35 percent by MacMillan Petroleum Corporation, is also drilling in the Ragusa area.

Possibly more important than Gulf's Ragusa strike was the discovery in early February of oil about 16 miles inland from the Adriatic coast city of Pescara, just across the Italian peninsula from Rome. The strike was made by Petrosud, S.A., an Italian company owned jointly by Gulf and Societa Generale per l'Industria Mineraria e Chimica (Montecatini), a private capital Italian company. The well, Cigno 1 on Petrosud's Abruzzi concession, was completed at a depth of 2545 feet and on preliminary tests produced 2000 barrels daily of water-free 34-gravity crude.

The discovery is in Central Italy about 200 miles southeast of the nearest Po Valley oil and gas production and is the first discovery of any importance outside the valley. Application has been made for a producing concession and interest has been revived by several companies in Italy's oil possibilities.

Five foreign companies—Standard Oil Company (New Jersey), Gulf, California-Texas Oil Company, Socony-Vacuum Oil Company, British Petroleum, Royal Dutch/Shell and Petrofina—operate refineries in Italy using Middle East oil. All of these companies, as well as numerous Italian refiners, would be interested in a source of domestic crude that would be cheaper than the heavily taxed imported oil. Though many are small marginal plants, Italy has refining capacity in excess of 450,000 barrels daily and presently imports about 290,000 barrels of crude per day which, after domestic requirements, permits exports of refined products.

Despite the communist agitation, several groups are working for a petroleum law that would be attractive to foreign capital, including the consideration of opening the Po Valley area to other companies. Premier Mario Scelba has favored a liberal oil law but proposals made a year ago to the cabinet were allowed to die rather than risk a defeat in parliament. Also a bill has been introduced that would liberalize the repatriation of dividends and capital by foreign firms investing in the Italian economy. —**The End**



IN ANCIENT ROME, life expectancy was 23 years at birth. A century ago, an American over 40 was living on borrowed time. In 1950, the average life span of an American was 68 plus. Where does the mandatory retirement age fit into this pattern of lengthening usefulness? and just . . .

How Old is TOO OLD?

Chronological age is no measure of ability. Healthy men over 50 can outproduce their juniors. So why discard them?

By IRVING LADIMER

SOME WEAR OUT, some rust out and some are forced out!

This stark summary of use and age applies to men no less than machines. But management has sometimes given less eye and ear to the men than to the machines with which they produce, develop and refine.

In the oil industry, which has a heavy stake in equipment and tools, the wary operator knows the value of full use of his material investment. He knows that rust, scale, obsolescence and neglect slim margins, cut profits. He sees to it that his working inventory is kept trim and up-to-date. He stresses flexibility and new uses for his light and heavy gear and tries to get the most out of it right up to the minute it's slated for the scrap pile.

Men Versus Machines—When mechanical factors are favored over human factors, industry gets poor labor return and falls short in commanding worker loyalty and respect. In tight labor periods, some management has also fallen short in production, because it has not had the vision to consider human needs and earn staff support.

—Not This

- Myths About Older Workers
  - Older workers are crabby
  - Older workers can't take supervision
  - Older workers can't learn
  - Older workers are inflexible
  - Older workers are not ambitious

(These are unestablished stereotypes disclosed by Dr. Irving Longe, Columbia University psychologist, based on interviews with workers and employers).

—But This!

- Older Workers Perform Well —But Differently
  - They stress accuracy over speed
  - Differences in individual performance increases with age
  - Industrial skills can be maintained at older ages than when *learned* under present training methods
  - Older people are more content and efficient in small work groups

(Based on laboratory studies reported by New York State Joint Legislative Committee on Problems of Aging).

The company which has gone beyond the legal requirements of workmen's compensation, old age and unemployment benefits and sick pay (in some states), has generally fared better in getting and holding a work force and in capturing community esteem. Attention has been given to safety, to recreation and welfare, to health exams and, lately, to utilization of older workers and guiding them into fruitful retirement. These fringes pay off in higher morale, employe pride, and security and family interest. For the company, it multiplies income directly in higher and better production; indirectly through less sickness absenteeism, reduced turnover, abbreviated training costs, and—not to be overlooked—lower retired pay and other costs of benefits due *after the job*. Instead, he gets work *on the job* from experienced, satisfied help.

It is important to have a complete employe program, especially when rival employers and rival industries, in today's market, compete lustily with such inducements. Stopping at third base adds no more to the score than striking out. You've got to bat the runner home. Or at least try.

Old But Not Out—When the Census Bureau recently changed its big register announcing a U. S. population of 160 million, many envisioned a smiling airborne stork carrying another bundle from heaven. True, of course, but the peak population figure owes its existence as much to continuing lives and fewer deaths as to new lives.

The number of people in this country has doubled in the last 50 years. The number of middle aged (45-64) has tripled and the oldsters (65 and over) has quadrupled. Today there are about 35 million at the half-century mark; and over 13 million are 65 or past, and this group is growing about 400,000 a year. One in every 12 is 65 or older.

How does this happen? Even though births are now on the increase, life expectancy and good health have generally advanced more steadily and markedly. Many childhood and infectious diseases have been licked. More of us are putting off the undertaker and many of us are living longer. In ancient Rome, life expectancy was 23 years at birth. A century ago, an American over 40 was living on borrowed time. In 1900, you were past the average at 48 years. In 1950, the average lifetime of the American peo-

AVAILABLE JOHNSTON by AL CAPP

THET'S ACCURATE SHOOTIN'!!
ONLY ONE GUY IN THESE PARTS, MO' ACCURATE THAN ME!!
THAT'S ME— ACCURATE JOHNSTON!!
AN' NOBODY'S MORE AVAILABLE THAN ME— AVAILABLE JOHNSTON!!
AVAILABLE FO' WHUT?— COURTIN'?
NO MA'M—FO' TESTIN' OIL WELLS, WITH MINNYMUM DOWN TIME!!
WE IS ALLUS FAST, AS WELL AS ACCURATE!!
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FORMATION AND CASING TESTING — JOHNSTON

Suggested Pattern For Your Program

1. Recruit older workers for suitable jobs
   Determine where they can be used by analyzing jobs now filled by older workers; studying job requirements; company production, medical, turnover, absence records.
2. Maintain older worker efficiency
   Adjust hours, work schedules, physical conditions (light, heat, noise). Provide proper facilities and tools. Give health examinations and advice. Offer personal counseling on aging problems: health, money matters, psychological adjustments, using individual and group techniques.
3. Reassign jobs
   Determine objectively when production declines and examine interest and capabilities for other work. Transfer instead of demote or downgrade by careful preparation and appeal to worker understanding. Use teamwork and group approach; don't single out individual workers.
4. Prepare for Retirement
   Basic educational program. Follow up special areas of interest and individual questions. Encourage further study by those desiring help or are stimulated by group discussion. Use outside specialists to cover particular subjects and lend authority to the guidance.
5. Retirement Policy
   Compare mandatory and elective age practices. Consider a "selective" process based on age, ability, objective tests, interest and financial status. Consider employe committee devices as a recommending group for voluntary retirement.
6. Post-Retirement
   Integrate the ex-employe into the company family by newsletter, service clubs, visiting programs, company facilities and retiring preference.

(Based on "Effective Use of the Older Worker" by Elizabeth Breckinridge, Chapter 13).

When we consider that by 1980, $28.8 billion for pensions of $100 a month might be paid to an estimated 24 million persons over 65 for *not working*, budget-balancing becomes a national nightmare.

ple reached a new high of 68 plus—a gain of 21 years since 1900. Whether, as Professor Pitkin wrote in "Life Begins at Forty," babies born now will live past the century mark hale, hardy and zestful remains to be seen. But not by us. We can easily see, however, that our population is older. Workers can stay on the job longer and can live longer afterwards.

The Issue We Face—This lengthening march of oldsters raises a cloud of gloom or outlines a new horizon of hope and possibility. When we consider that by 1980, $28.8 billion for pensions of $100 a month might be paid to an estimated 24 million persons over 65 for not working, budget balancing becomes a national nightmare. Support of nonproductive people—our children, the sick and disabled and the aged, if not employed—must come out of national production. In the long run, there must be direct aid or government benefits supported by taxes. The dollar drain can be somewhat reduced by keeping older workers on the job and by preparing them for reasonably independent living afterwards. A potential increase of at least 600,000 in the labor force is possible today by utilizing older workers capable of working under proper conditions. Industry must find a way to adjust jobs to meet their abilities.

Problems or Potentials?—The main questions raised by an aging labor force are: opportunities for effective contribution on the job and preparation for a useful after-work lifetime.

Judged by its interest in employe welfare, petroleum is well ahead of most American industry in accomplishment and potentiality. According to an impartial government study, oil industry "benefits in the event of death, sickness and accident, and old age . . . are of special significance because they are illustrative of the rather comprehensive employe-benefit programs developed over the years by firms that have given a great deal of attention to the problem involved." And this is not just a recent or passing interest. Standard Oil Company (New Jersey) has a program 50 years old.

Practically all plans are sponsored and run by the companies. However, almost all are jointly supported, at least in part, by employer and employe contributions. This pattern contrasts sharply with the usual industrial plan, conceived and pressured into being under wartime stabilization and collective bargaining. Without comparing individual benefits and total programs, it is clear that oil has demonstrated a longer, better established and less opportunistic concern for these fringe conditions. On this basis, as well as its respected employment standards, oil can also pioneer in the subtler yet more meaningful programs of utilizing older workers and schooling them for a satisfying old age.

The oil industry has an impressive head start—a solid industry, a tradition of employe welfare, and future prospects unlimited in a nation built on, and built for, power. The conditions and opportunities are ripe for improving further and where it

Population of the United States, by Age and Sex: 1900 to 1950
(Percentages based on rounded figures. Figures for 1900 to 1930 adjusted to include persons of unknown age)

AGE	NUMBER (in millions)						Percent Increase 1900–1950	PERCENT DISTRIBUTION					
	1900	1910	1920	1930	1940	1950		1900	1910	1920	1930	1940	1950
Total, All Ages	76.0	92.0	105.7	122.8	131.7	150.7	98	100.0	100.0	100.0	100.0	100.0	100.0
Under 10 Years	18.1	20.4	23.0	24.1	21.3	29.4	62	23.8	22.2	21.8	19.6	16.2	19.5
10 to 19 Years	15.7	18.2	20.1	23.6	24.1	21.7	38	20.7	19.8	19.0	19.2	18.3	14.4
20 to 34 Years	19.5	24.2	26.5	29.9	32.9	35.2	81	25.6	26.4	25.1	24.3	25.0	23.4
35 to 44 Years	9.2	11.7	14.2	17.2	18.3	21.5	134	12.1	12.7	13.4	14.0	13.9	14.3
45 to 54 Years	6.4	8.4	10.5	13.0	15.5	17.3	170	8.4	9.1	9.9	10.6	11.8	11.5
55 to 64 Years	4.0	5.1	6.5	8.4	10.5	13.3	232	5.3	5.5	6.2	6.9	8.0	8.8
65 and Over	3.1	4.0	4.9	6.6	9.0	12.3	297	4.1	4.3	4.6	5.4	6.8	8.1

Source: Adapted by the Bureau of Labor Statistics from U. S. Bureau of the Census. *U. S. Census of Population: 1950*, Vol. II *Characteristics of the Population*, Part I, United States Summary.

counts most: with the experienced, loyal worker who is prepared and anxious to serve as long as he can, given the chance, and who will reflect credit on the company once he leaves.

Tailor the Plan—The keystone of any program for keeping workers steadily, or at least effectively, on the job and training them for life after the job is to gear the plan into the regular company environment. New ideas, modern methods and latest findings should be considered, but *applied* and *adapted* to company traditions and policies. That's why the facts and figures on the industry's experience and attitude toward employe benefits has meaning, why the character of the labor force was studied and its record of employment and wages. Without this background, there would be no point at which to start and, worse, no point of return.

Since the industry has fair wages, a good network of welfare plans and a steady work group with family interests, we can reasonably consider personnel utilization and worker retirement. Otherwise, on the simple formula of first-things-first, the industry would do well (and individual companies should study their standing) to institute cash and service benefits, better working conditions and health and safety programs.

Work versus Retirement—The issue that rises to the top in this crucible of problems on the older worker is fixed versus flexible retirement. Traditionally, where pension systems existed a compulsory quitting age was set. Why? It was argued that such a rule forced workers to prepare; that it insured relatively steady promotion for younger men; that it permitted more accurate labor cost accounting; that it ruled out favoritism and finally, that this certainly was desired and deserved.

Many of these arguments, in particular situations, are valid, but are probably invalid when applied unconditionally. They wrongly assume that chronological age is a proper measure of ability, that people do in fact plan against a certain eventuality, that we have a static rather than dynamic and expanding economy and, worst error of all, that people prefer not to work.

Many firms are re-examining mandatory retirement policies in light of scientifically proven facts that older men are capable of learning new techniques and are definitely more reliable and punctual. Their experience and training often more than outmatch physical strength and endurance. Also, economic studies have established that age makes no difference in desire to work, to keep active and to contribute when, if well, men over 60 and 65 generally outproduce their juniors. And many who have health handicaps can continue effectively in lighter work, at shorter hours, under adjusted work conditions and, underscore this, with sympathetic management.

Learn Before Leaving—Assuming management through its democratic processes has worked out means for profitable use of senior employes through work scheduling, retraining, transfer and adjustment for handicap with fair wage scales, there still remains the job of preparing for the eventual leaving. Whether retirement is must or maybe at a certain age, there will be a severance. According to the current life tables, a man at 50 has 23 years ahead of him, at 60 about 16 years and at 65, about 13. At 70, he can on the average look forward to another decade. For women, these expectancies are even greater.

A study of plans designed to anticipate retirement properly undertaken by the Executive Secretary of the Illinois Committee on Aging (1952), discovered that interested companies want to know: When to begin such a program, how, what should it cover, should it be separate, what responsibility should the personnel, medical or other department take, and, how can acceptance be obtained.

Obviously, there are no set rules, but the familiar principle of erecting new structures on well-established foundations still holds. Preferably, the concept of planning should begin when the employe enters—he should at least be advised that the medical, safety, employe benefit and counseling programs have been united so that he may rise within the company and, upon release, will be prepared for a rewarding retirement.

How? Companies have used preretirement interviewing, individual counseling, group lectures and discussions, global education, house organ articles and global articles distributed through the usual channels.

Many firms deliberately abstain from too specific or individual consultation. They feel "there is a definite limit to corporate participation in personal matters." The company helps, advises on request and provides general information. Again, the method should be suited to the techniques found effective for other communication. It is unwise to single out the older worker problem, emphasizing its importance to the possible detriment of other matters.

What? Socony-Vacuum Oil Company, which has considerable experience, covers these subjects in its preretirement interviews and discussions:

Employe benefits: Sick leave, insurance, disability and annuity policies as applied to the individual.

Medical findings and advice as to current work and future care.

Determination of personal interests and hobbies to suggest later opportunities.

Plans for retirement, including financial needs, living costs, proposed activities in the community and other later life problems.

Understandably, personal and family relationships are generally not discussed. General information is afforded and arrangements may be made for specialist aid, depending on the company view of its employe program.

After Retirement—Some firms continue interest in employes after they leave. Marshall Field, Chicago department store, follows the practice of retire and rehire, calling back pensioned workers for one or two months work a year in rush seasons. Production plants engaged in seasonal work try to maintain contact with retired workers to insure a labor reserve when needed.

Almost all companies with established employe communication programs keep pensioners on the list to receive house organs, invitations to company picnics and affairs and even extend regular employe privileges and discounts to ex-employes.

Trends—The rapid rise in interest suggests that the wide-awake company must consider broadly its employe relations program. Give special, but not exclusive, attention to maintaining older workers to the mutual benefit of employer and employe; give further attention to preparing employes, through careful guidance, for their after-work lifetime.

Companies which have adopted plans have testified that they pay off in increased profit, in satisfied work force, in better community relations.

—The End

Expectation of Life and Mortality Rates United States, 1950

Age Years	Expectation of Life In Years	Mortality Rate Per 1000
	Total Persons	Total Persons
At Birth	68.4	29.2
10	61.0	.5
20	51.5	1.3
30	42.2	1.8
40	33.1	3.6
50	24.7	8.7
55	20.9	13.0
60	17.3	19.6
61	16.7	21.2
62	16.0	22.9
63	15.4	24.5
64	14.7	26.2
65	14.1	27.9
69	11.8	38.0

Source: Statistical Bureau of the Metropolitan Life Insurance Company from the abridged life table prepared by the National Office of Vital Statistics, Department of Health, Education and Welfare.

THE CHANGING PANORAMA

WORLD OIL's Views of the News

• Gas legislation slowed by politics as usual . . . • Industry takes gas case to people, gets results . . . • Gasoline tax increases talked in several states . . . • Imports fight goes to Senate . . . • Producers wage hot struggle for markets.

Politics Hobbles Gas Bill

The legislative machinery that could carry the gas industry out of reach of federal regulation gave off a few snorts and rattles last month, but made no forward progress for lack of a driver.

Well-meaning solons convinced of the necessity for an amendment to the Natural Gas Act were apparently remembering the abuse heaped on Senator Kerr when his bill was introduced in 1950. So Democrats and Republicans alike were apparently waiting for the other to act.

A bevy of bills went into the hopper, but none with the backing of industry's General Gas Committee, and Capitol opinion was that the big pro-industry effort, when it comes, will be behind a bill offered by Rep. Percy Priest of Tennessee or Rep. Oren Harris of Arkansas, both Democrats. Priest, who is chairman of the House Commerce Committee, has said that hearings on proposals to amend the Natural Gas Act won't be heard until "sometime in March."

Senate sources meanwhile offered the gloomy opinion that gas legislation in this session is unlikely unless President Eisenhower's Cabinet Committee on Fuels Policies immediately issues a favorable recommendation, thus giving the legislation a bipartisan flavor.

Just how valuable such a recommendation would be was attested by a strong statement from Speaker Sam Rayburn of Texas, who saved the Kerr Bill from defeat in the House five years ago. Rayburn declared that though Congress has been in session a month it still has heard nothing from the cabinet committee. "I don't know if they're playing a waiting game or not, but at least I don't like it," he declared.

In effect, he declared that Congress cannot act with success until the recommendations are received.

President Eisenhower was quick to defend his cabinet committee. This is a very complicated study which is being worked on constantly, he declared. He pointed out that the study must consider competition from various types of fuel, from electric power to power produced from residual fuel imports.

New Gas Tactic Pays Off

"It is hard to believe that Congress will ignore the record of an industry which has increased its customers by millions within a single decade, while keeping the ultimate cost low during a period of inflationary prices. What more could be accomplished by federal regulation of this business is hard to imagine . . ."

This paragraph in *The Saturday Evening Post* last month was heartening new evidence that industry has at long last chosen an effective approach to the once seemingly hopeless task of rectifying the Natural Gas Act.

Until recent months the approach was one of trial and error, and a time of trial and error it indeed was.

Until 1950 the accepted approach was in the name of Justice. The everlasting futility of this route became manifest when an uproar from the misinformed daily press panicked President Truman into vetoing the Kerr Bill.

Next the industry tried Logic and was frustrated by the Supreme Court, whose myopic views on the case were admitted by one of its members, Justice Douglas, who declared in a dissenting opinion that the problem "involves considerations of which we know little and with which we are not competent to deal."

And now at last, having tried the case in the Congress, the press, and the courts, industry is going directly to the people, and with arguments containing less misty idealism and more dollars-and-cents realism. Complaints that the noose of FPC control is throttling the industry are deemphasized in favor of warnings that the public's gullet is also being encircled. Arguments like those cited by Paul Kayser, president of El Paso Natural Gas Company, before the National Editorial Association, are being hammered into the public consciousness. Federal regulation of gas prices, said Kayser, will:

> ". . . Inevitably restrict exploration and reduce the amount of gas available for consumers' demands." (Thus, you, the public, will pay more for gas.) ". . . Lead to the regulation of other competing fuels such as oil and coal, as well as other commodities like lumber, wheat and cotton." (Thus, you, the public, will next be regulated.)

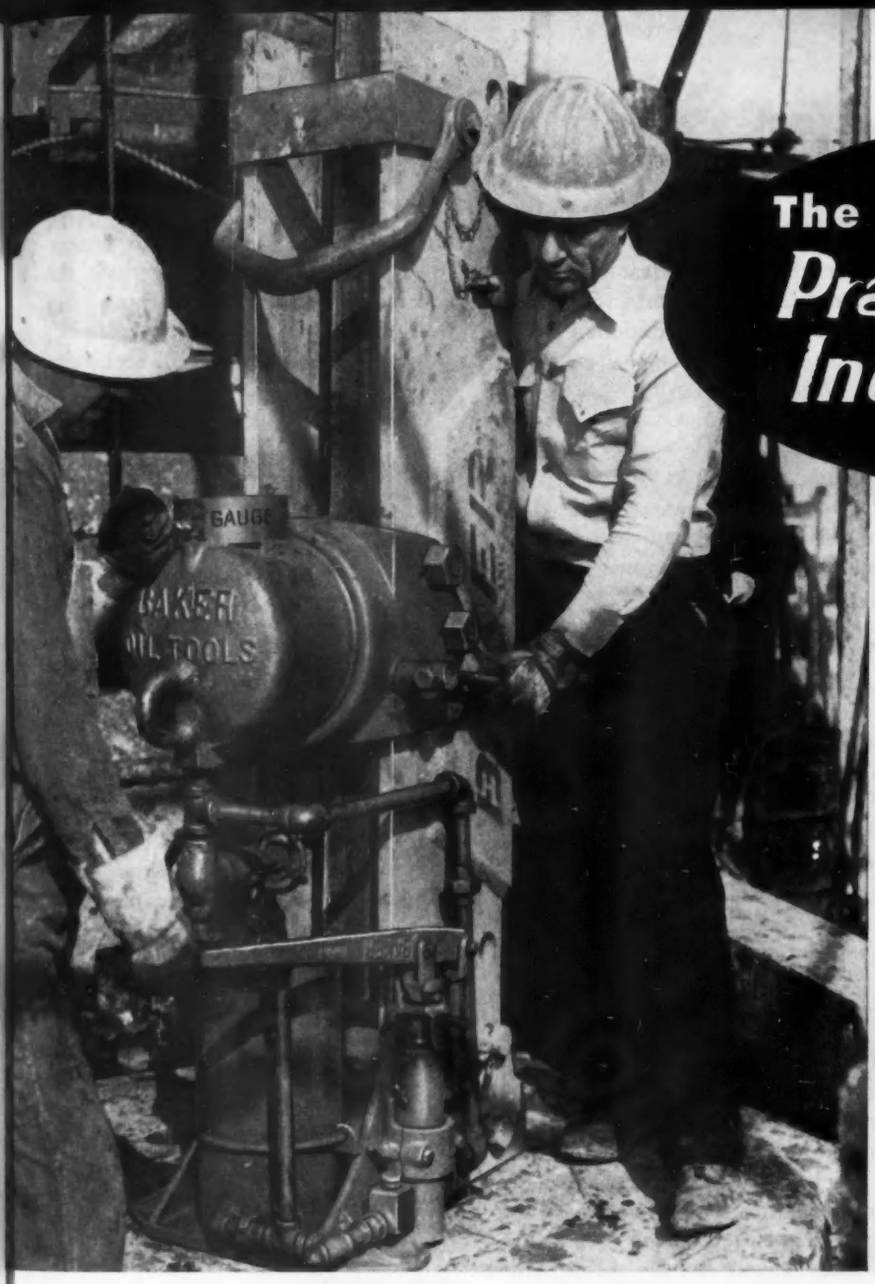
The editorial in the *Post,* one of the nation's great consumer magazines, can mean only that industry is at last awakening response at the grass roots level.

The *Post* commented further: "The Supreme Court's decision of last year will certainly produce a new battle in Washington. It will be unfortunate if the debate becomes so intense that the basic principles involved are generally ignored. One of these certainly is that any move to impose regulation on an American industry should be supported by substantial evidence that a need for regulation exists and that the measures sought are consistent with the operation of a free economy."

Democrats Planning Probe

Bruised bystanders at the party-line brawls in this closely-divided Congress are due to receive some new bumps from an investigation of the House Small Business Committee.

Controlled by Democrats and eager to plaster the "big business" label on



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. . . is while they hang in their normal vertical position in the derrick

And remember, a drilling string free from kinks or bends ensures more efficient operation at lower cost.

It costs far less to remove the kinks and bends from Kellys, drill pipe and drill collars *right in the derrick* while they are *suspended in a vertical position.*

And you eliminate the expense, lost time, and the always present danger of *again bending and kinking* the Kelly or drill pipe when it is laid down, trucked to the shop, and then returned to the well and pulled into the derrick.

The BAKER *Portable* Hydraulic KELLY STRAIGHTENER is easily handled by the catline, set on the rotary table, and all shapes and sizes of Kellys, drill collars and drill pipe can be quickly, practically and safely straightened in the derrick.

Send for New Folder *. . . which contains complete details, specifications and operating data. Find out why it pays all ways to do straightening at the rig.*

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Many operators look ahead and use a Baker Kelly and Pipe Straightener at the pipe rack to straighten drill pipe before being made up in the drilling string.

BAKER KELLY and PIPE STRAIGHTENER

(Product No. 550)

the Republican Administration, the group plans probes of several industries, oil among them.

The head of the Federal Trade Commission will be called in to answer complaints that his agency has been lax in protecting small business.

The Federal Power Commission will be asked to justify rate increases allowed gas pipe line companies, and why the delay in imposing regulation on independent gas producers.

A subcommittee on manufacturing and distribution will look into complaints of gasoline dealers concerning "unreasonable" lease renewals.

Politics on the Highways

More Congressional politicking was swirling around the President's $101 billion road program.

Apparently to prevent the Republicans from grabbing off credit for an improved 40,000 miles of interstate highways, the Democrats rushed in with a bill authorizing $1.6 billion for highway construction in the next five years.

The President's plan is to pay much of the government's $31 billion share (the states would pay the other $70 billion) with 30-year bonds. The Democrats' would pay for their program with pay-as-you-go, designed to be less offensive to voters.

New Job for Jack Knight?

Advancement of AFL-CIO merger plans by leaders last month at Miami heightened the opinion that O. A. (Jack) Knight, president of the Oil Workers International Union—CIO, will be one of the top vice presidents when the new 15 million-man combine goes into operation, perhaps in 1956.

The unity agreement calls for 27 vice presidents, with ten from the CIO. Knight is the senior officer in the CIO unions now connected with the petroleum industry, and at month's end he was slated to take over the presidency of the International Oil & Chemical Workers Union—CIO. This was the label for the union which was to result from the Cleveland merger of the OWIU and the United Gas, Coke & Chemical Workers Union-CIO.

The projected merger of the AFL-CIO, said Knight last month, will bring no immediate change in collective bargaining relationships of present unions and their companies.

Imports Fight to Senate

Independent producers lost a fight but not their hopes last month in the Congressional imports struggle.

As expected, the President's three-year extension of the Reciprocal Trade Agreements Act cleared the House without amendments requiring imports curbs. Not expected was opposition so brisk as to force some quick and canny maneuvering from Speaker Sam Rayburn, an oil-state Democrat stubbornly, and perhaps unhappily, intent on hewing to the bi-partisan line.

The independents and their allies, notably coal, were brushed aside in the House Ways and Means Committee, which reported out the Act with no quota restrictions by a vote of 20 to 5.

The first vote on the floor was on whether to end discussion of the closed rule proposal to bar amendments. It was here that the independents scored a 206-178 victory that brought Rayburn into action. The Speaker drove a wedge into the protectionist group by warning that "you may get your amendment adopted, but then you will feel compelled to vote for a bill on final passage, although it will contain many other amendments to which you seriously object."

The President rushed in with a statement that he would very much deplore seeing the nation going backward to establishment of legislative quotas.

Thus coaxed into line, the House voted 193 to 191 against a motion to open the measure to amendment. The House then approved the closed rule, 193 to 192.

An amendment pushed hard by the protectionist group would have required the President to follow Tariff Commission findings in escape clause proceedings unless "national security" demanded otherwise. State Department officials declared this would have tied the President's hands.

The protectionists hope to add many Senate amendments to the bill to increase tariff protection. There is also the possibility of a delaying action with the hope that the protectionists' stand will be strengthened later this spring by current tariff-cutting negotiations with Japan and other countries.

States May Raise Gas Tax

Agitation is sweeping a number of states to raise gasoline taxes.

Texas and North Dakota would join a select group of states now imposing 7 cents a gallon. Opposition to the hikes is developing.

A map issued by the Mid-Continent Oil & Gas Association shows the breakdown by cents per gallon tax:

7 cents—Florida, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina and Tennessee.

6½ cents—Arkansas, Oklahoma, Washington.

6 cents—Alabama, California, Colorado, Georgia, Idaho, Oregon, Montana, New Mexico, Nebraska, Virginia, Maryland, Maine, and the District of Columbia.

5½ cents—Nevada.

5 cents—Arizona, Utah, Wyoming, North Dakota, South Dakota, Kansas, Minnesota, Iowa, Illinois, West Virginia, Pennsylvania, Delaware, Vermont, New Hampshire and Massachusetts.

4½ cents—Michigan.

4 cents—Texas, Wisconsin, Indiana, New York, New Jersey and Connecticut.

3 cents—Missouri.

Colorado Tax Pushed

If the oil industry sues to invalidate his state's gross income tax on oil and gas production, Colorado Governor Ed C. Johnson says he will ask the state legislature to pass "a real severance tax—one like other states."

Declaring his stand was not one of threatening industry, Governor Johnson said if the gross income tax law is invalidated, he will call a legislative session to initiate a constitutional amendment to legalize a severance tax.

Earlier, the California Company counsel said an appeal will be made to the courts on refusal of State Revenue department to refund almost $1 million in production taxes paid under protest for 1953.

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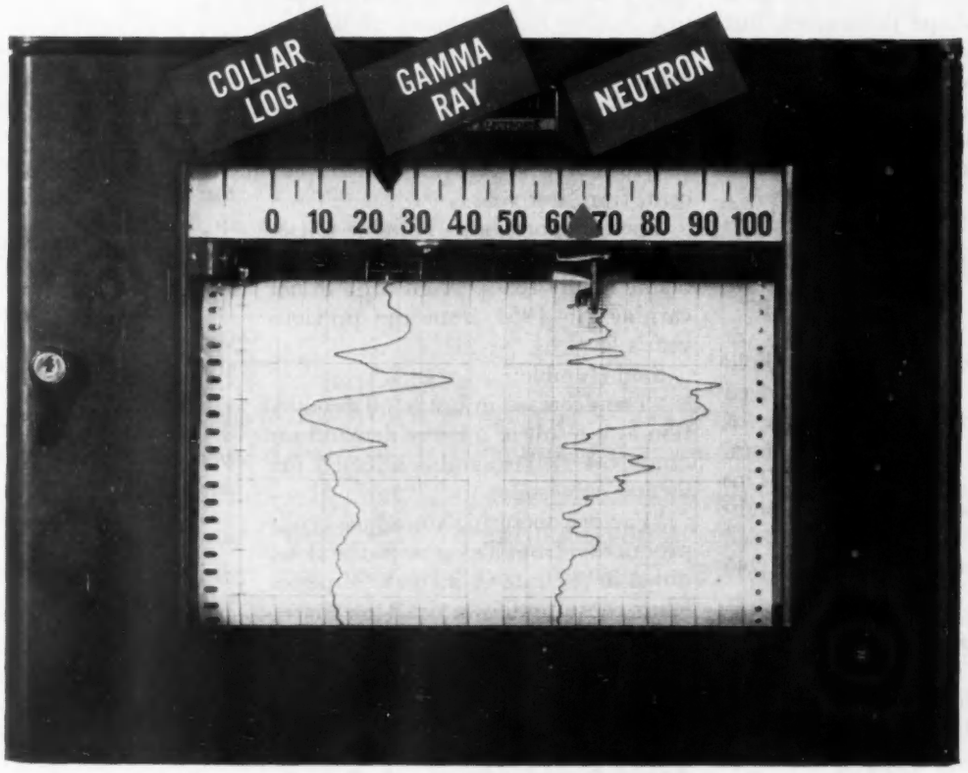

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Fight for Markets Waged

Long wondered about, often guessed at, the actions of various oil-producing states engaged in the sharpening struggle for domestic crude markets have begun to shape themselves. But they may only add to the fire of discontent which began sputtering when domestic producers first felt imports were supplanting, instead of supplementing, domestic crude.

The controversy, now full-fledged, centers about imports and crude offered to U. S. markets by states which practice no proration programs.

Texas, apparently moving to hold its markets in a tight grasp, approved a producing schedule of 18 days for March, making a statewide total daily yield of 3,279,263 barrels. This will result in the state's second highest oil quotas in history, exceeded only by a permissive flow of 3,387,245 barrels daily in November, 1952.

Oklahoma, however, points to a steady decline in its traditional oil market and feels it is not being treated fairly by certain major oil purchasers. This view is reflected in statements by independents as well as in official circles.

Oklahoma Governor Raymond Gary blames certain oil-producing states which do not prorate production and said he "feels all states should practice conservation" and that "it is not fair for Oklahoma to hold down production and let some states run their production uncontrolled."

Meanwhile, the Oklahoma legislature, which is now in session, is studying the oil situation. Among bills under consideration is one that would set by law a minimum daily allowable of 25 barrels on a lease basis for Oklahoma wells.

Texas' allowable boost and Oklahoma's consideration of a 25-barrel daily minimum came in the face of a warning by the Independent Petroleum Association of America that substantial cutbacks in domestic crude production may be necessary in March and April as result of increased imports and slackening market for domestic crude.

Imports, the continuing center point in this controversy, are on the upswing. IPAA says imports for February through April will total 1,250,000 barrels a day. Last year, daily average total imports amounted to 1,063,000 barrels, based on Bureau of Mines figures for the first 11 months and American Petroleum Institute total for one month. Thus, imported oil has risen an average of 187,000 barrels daily, or 17.6 percent, from last year.

These imports, says Humble Oil & Refining Company, are partially to blame for its 10.9 percent drop in net earnings in 1954 from the previous year's level.

Said Humble:

"The decrease in crude oil production as a result of a lower demand for crude oil in Texas also affected net income adversely.

"Factors operating to reduce crude production from Texas were the slowdown in the rate of increase of petroleum consumption, a draft on inventories accumulated in 1953, and the failure to reduce imports in relation to the reduction in domestic production."

Steel Supply Outlook Good

General outlook for steel supplies for the petroleum industry this year is good despite the growing demand by automotive, other durable goods industries and the export market. Steel production operations in recent weeks have been at about 85 percent of rated capacity, its highest pace in more than a year.

While there have been indications of a tight squeeze in supply of some steel products, primarily cold rolled sheets, industry officials say that, barring an all-out war in 1955, there is ample steel capacity to supply oil country tubular goods and line pipe to meet the needs of an estimate by WORLD OIL of 52,612 new well completions and a prediction by *Pipe Line Industry* for the laying of 19,900 miles of new crude, natural gas and products pipe lines.

There is a growing demand for high tensile casing which is more desirable for use in deep wells. While the steel industry's capacity to produce this material is limited, it is growing. Over-all, industry sources say the market for oil country tubular goods and line pipe is still quite competitive regardless of the tightness of supplies of some other steel items. Total supplies of drill pipe, casing and tubing in warehouses and operators' inventories are considered ample, though over-all inventories have not reached the level of prewar years.

Expanded production capacity and improved shipping schedules have reduced the needs for the prewar type of heavy warehouse inventories, though some observers predict that the Far Eastern situation could result in a flurry of advanced orders of oil country tubular goods for stock-building purposes. It is not expected, though, that advanced orders for inventory building would result in any curtailed supplies for current needs.

Shipments of oil country tubular goods and line pipe (excluding imports), the largest volume steel items used by the petroleum industry, last year declined by nearly 12 percent from 1953 to total 5,526,663 tons. Shipments of oil country tubular goods increased from 2,019,345 tons to 2,291,176 tons, reflecting a substantial increase in total wells completed and footage drilled. Line pipe shipments, however, declined to 2,594,873 tons in 1954 from 3,507,318 tons the preceding year. There was a slight decline in total pipe line mileage completed in 1954 from the previous year and a decline in the total mileage of large diameter pipe lines completed.

Another Well for Nevada

Nevada is about to emerge from its year-long status of a one-well state. In a step-out about 1800 feet southwest of its initial discovery well completed last year, Shell Oil Company reported a drill-stem test in its Eagle Springs 35-35 indicated a flow of approximately a 768-barrels per day rate of an estimated 29-gravity crude.

The new well, on a 2½-hour formation test at 6606-78 feet, recovered 6000 feet of gassy oil. Prior to that test, in the 6586-6678-foot interval, the packer failed to hold on three attempts to run a formation test, the only recovery being 900 feet of slightly gas- and oil-cut viscous mud. The well was drilling and coring below 7000 feet near the end of the month.

Shell's original discovery, Eagle Springs Unit 1, completed on the pump June 15, 1954, from open hole interval at 6450-6730 feet in volcanics

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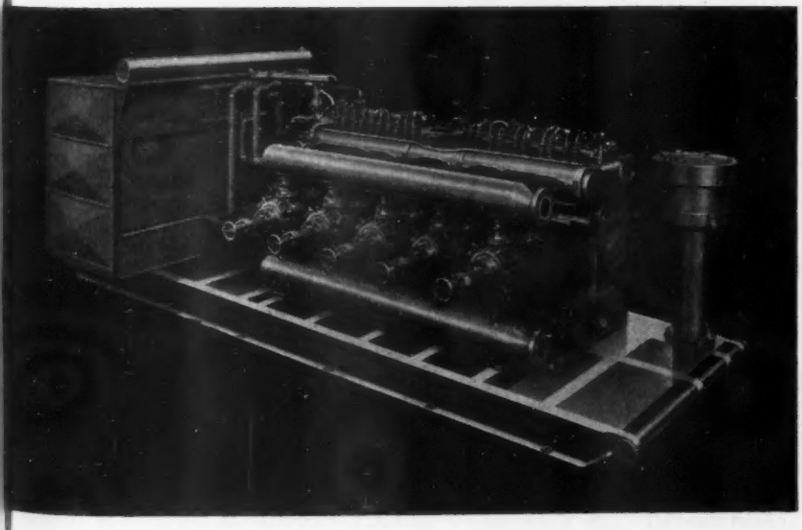

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of probable Tertiary age, still was producing at a rate of about 200 barrels a day. Oil is being trucked to Salt Lake City.

The discovery and the present indicated producer are in Railroad Valley, in central eastern Nevada, approximately 65 miles southwest of Ely.

Shell has drilled and abandoned two other wildcats in the same area since completion of the initial discovery last summer. Eagle Springs Unit 3 five miles south of the discovery, was bottomed in Cambrian topped at 5983 feet. Some spotty oil staining was found in the Devonian section at 5415-27 feet, but no commercial production. Eagle Springs Unit 2, nine miles southwest of the discovery well, was abandoned in December at 10,183 feet without finding anything of commercial importance, although staining was found in volcanics between 7150-7230 feet. The volcanics (which, in the discovery well included a productive section) in this unsuccessful test were topped at 6150 feet.

Seven miles north of Shell's first discovery, Bandini Petroleum Corporation last November abandoned an attempt to find commercial production. The only shows encountered were gas at 4300 feet in the volcanics. The well was bottomed at 5552 feet in the Devonial formation.

Mines Bureau Cites Gains

U. S. crude production was put at a record 6,458,000 barrels per day for 1953 by the Bureau of Mines in its annual statement. This was a gain of 3.2 percent over 1952.

The Bureau also reported for 1953:

Stocks were down 1000 barrels daily, indicating a demand for domestic crude averaging 6,459,000 barrels daily, a gain of 3.8 percent over 1952.

Average value of crude at the wells rose from $2.53 per barrel in 1952 to $2.68 in the following year.

Total number of new oil wells completed rose from 23,446 in 1952 to 25,762 in 1953.

Number of producing oil wells increased from 488,520 on Dec. 31, 1952, to 498,940 at the end of 1953.

Crude runs to stills set a new record in 1953, averaging 7 million barrels per day, a gain of 330,000, or 4.9 percent compared with 1952.

In brief . . .

Pipe lines took 7.5 percent more natural gas in Texas during December than in December, 1953, the Texas Railroad Commission reported. Sales to pipe lines totaled almost 352 billion cubic feet, or 70 percent of all the gas marketed from Texas wells. Interstate shipments were 248 billion cubic feet, a gain of 6.8 percent over December, 1953.

Congress has been asked to permit Interior Secretary to negotiate leases, rather than hold competitive bids, on acquired structure lands where the U. S. owns less than complete title or interest in mineral deposits.

Investment guarantees totaling $8.4 million have been granted Socony-Vacuum Oil Company on its investment in an Italian subsidiary. The government grants the insurance under a program to encourage American investment abroad.

Union Oil Company of California announced immediate start of a $5 million pilot program planned to develop reserves an estimated 5 billion barrels of shale oil in the 50,000 acres owned by the company near Rifle, Colo.

The Oil Workers International Union—CIO says it has acquired 4363 new members since last August 1.

Drilling of California's tidelands will probably be authorized this year, in the opinion of A. C. Rubel, vice president of Union Oil Company of California. However, no significant exploratory effort can get under way for two or three years because of deep water and high operating costs, he believes. He estimated the expenditures to date for offshore seismic exploration by Western oil companies to exceed $16 million.

U. S. military petroleum requirements will be about 7 percent greater for fiscal 1956, which begins July 1, than fiscal 1955.

Chile and Bolivia have agreed to grant required facilities for construction of an oil pipe line from Oruro, Bolivia, to Arica, a Chilean port, to move crude produced by Yacimientos Petroliferos Fiscales Bolivianos, Bolivian oil agency.

TIPRO Pushes Waste Bill

The scrappy Texas Independent Producers and Royalty Owners Association was lending its muscles last month to a legislative haymaker aimed at raising lumps on the interstate pipeliners and goose pimples on the Federal Power Commission.

The proposed law is an "Economic Waste Bill," which would empower the Texas Railroad Commission "to determine the value or values required to be received or attributed to gas produced from any well, field or area of a field in this state to prevent waste . . . ."

For the enlightenment of those who construed the word "value" as meaning price-fixing, TIPRO immediately tabbed the measure as "an anti-price-fixing measure." It will, said TIPRO, "eliminate the present price fixing of natural gas by the powerful pipe line monopolies in Texas."

TIPRO declared that "a huge volume of natural gas is committed for delivery to Northern and Eastern factories for boiler use. After being piped 1500 miles, this Texas gas sells more cheaply than it does at home. This is indeed an economic waste of a great natural resource. The bill will make it impossible for big pipe line companies to buy enough 3 and 4 cents gas to capture and subsidize Northern industrial markets."

TIPRO is just as positive that the measure would "go far toward erecting an effective barrier against federal regulation and control of the entire gas industry." However, at Houston, where TIPRO President Jack Woodward of Dallas made a stand in his fast-hopping tour over the state in defense of the measure (and for a Natural Gas Act amendment and a tariff on imports), he refused to concede that the measure, by setting a floor on "values," would necessarily bring on a collision with FPC price ceilings.

He drew the analogy of a rifle-toting farmer standing in the path of a pipe line spread. Without pointing the gun or offering a threat, the farmer might prevent his property line from being crossed.

For the time being, at least, FPC officials decline to deny the point. Said Commissioner Seaborn L. Digby: "There has . . . never been a test case of this type even though Kansas and Oklahoma have minimum price laws."

The Family's Grown to 58

It seems like a long time ago that Bethlehem had its first little group of supply stores, and we can't help thinking how times have changed. When we look at photographs of those original layouts and compare them with today's big stores, like the one shown here, it's a reminder that the oil business has come a long way.

Because if the industry hadn't grown, our business wouldn't have, either. We know that each new Bethlehem Supply store is a sign of progress, a marker in our own family history and that of the industry at large.

All of the 58 Bethlehem stores—the total today—are stocked with the latest, most modern types of equipment and supplies. At practically a moment's notice these stores can furnish you valves and fittings, hose, packing, gaskets, paints and hardware, belting, pipe, drilling equipment, pumping units, wire rope, sucker rods, bottom-hole pumps, or just about anything else you want. As long as you're close to a Bethlehem store, it's needless to carry large, expensive inventories. Bethlehem carries your field supplies in stock.

Come in and meet our people, won't you? See what they have to offer. They're the friendliest folks on earth, and you can rely upon them to work with you all the way.

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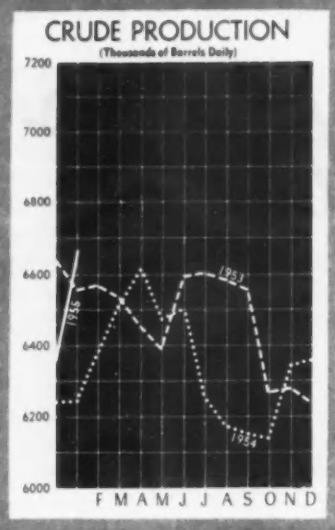
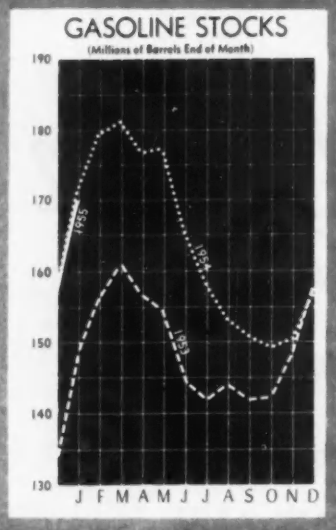
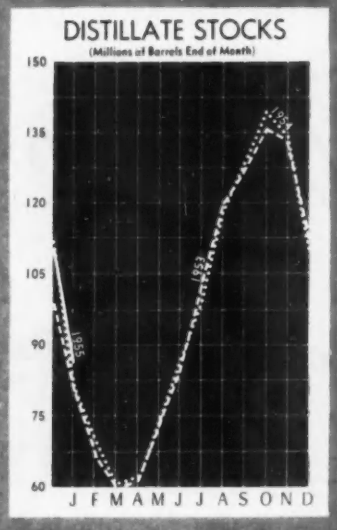
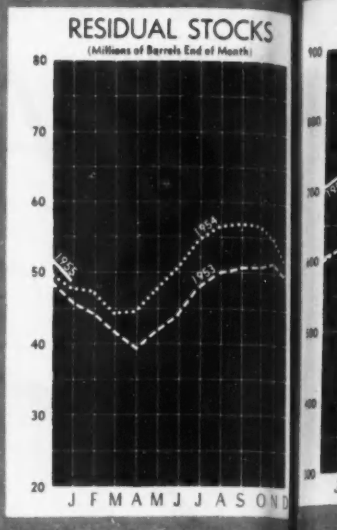
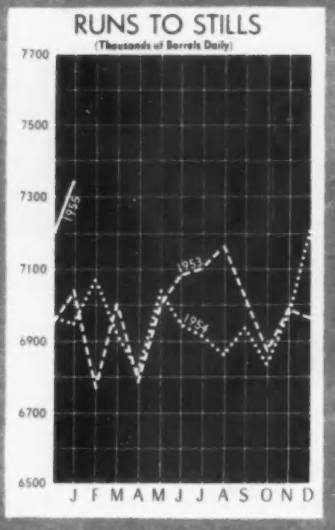
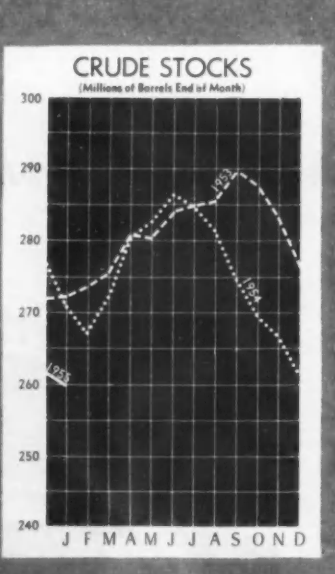












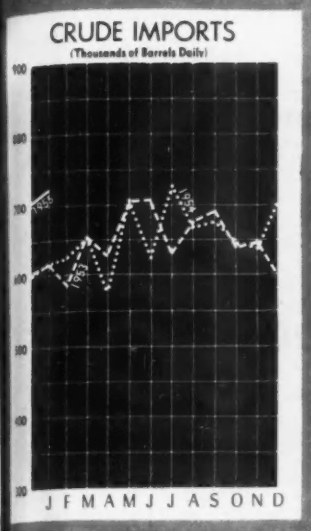
Petroleum Trends in U. S. . . .

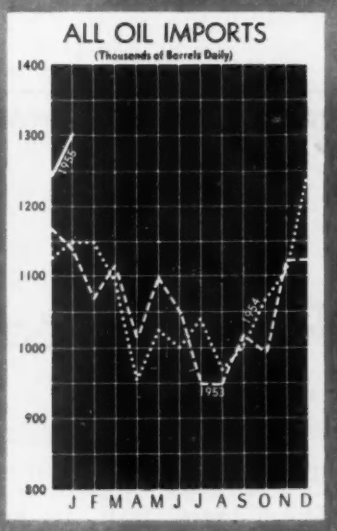
By CECIL W. SMITH, World Oil Staff

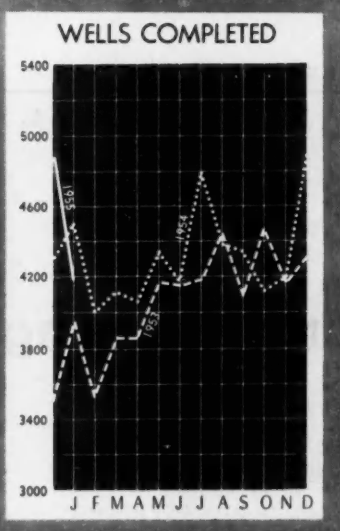
U. S. Crude Production by States

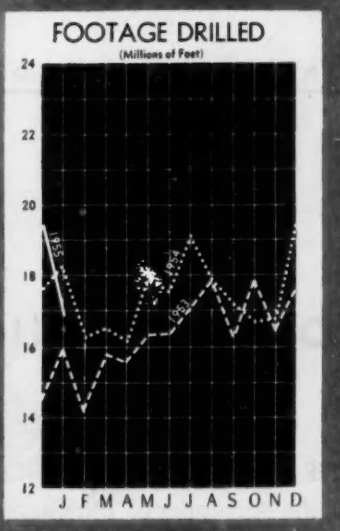
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION		
	January, 1955	December, 1954	January, 1954	% Diff. January, '54-'55	January, 1955	January, 1954	% Diff. '54-'55
Alabama	4.2	3.9	4.6	— 9.1	130	143	— 9.1
Arkansas	73.4	72.3	78.6	— 6.6	2,276	2,436	— 6.6
California	970.3	967.4	999.9	— 3.0	30,078	30,998	— 3.0
Colorado	141.1	140.5	88.3	+ 59.8	4,374	2,738	+ 59.8
Florida	1.4	1.4	1.5	— 2.2	45	46	— 2.2
Illinois	204.2	194.9	166.5	+ 22.7	6,330	5,160	+ 22.7
Indiana	29.3	29.0	32.5	— 9.8	909	1,008	— 9.8
Kansas	325.6	319.7	304.4	+ 7.0	10,095	9,437	+ 7.0
Kentucky	39.4	39.2	34.4	+ 14.5	1,223	1,066	+ 14.7
Louisiana	687.3	645.3	696.6	— 1.3	21,307	21,595	— 1.3
North Louisiana	106.0	104.1	112.8	— 6.0	3,286	3,497	— 6.0
South Louisiana	581.3	541.2	583.8	— 0.4	18,021	18,098	— 0.4
Michigan	33.2	32.0	32.8	+ 1.6	1,031	1,015	+ 1.6
Mississippi	94.3	93.3	93.8	+ 0.4	2.921	2,909	+ 0.4
Missouri	0.2	0.2	0.1	+ 25.0	5	4	+ 25.0
Montana	42.5	37.9	28.7	+ 48.4	1,318	888	+ 48.4
Nebraska	25.2	22.5	18.7	+ 34.5	780	580	+ 34.5
Nevada	0.2	0.2	.....	.....	7	.....	.....
New Mexico	214.3	212.2	199.4	+ 7.5	6,642	6,181	+ 7.5
Southeast New Mexico	212.9	210.9	197.1	+ 8.0	6,600	6,111	+ 8.0
Northwest New Mexico	1.4	1.3	2.3	— 40.0	42	70	— 40.0
New York	10.6	11.2	8.8	+ 20.9	330	273	+ 20.9
North Dakota	28.8	24.3	14.7	+ 95.6	894	457	+ 95.6
Ohio	10.6	10.9	9.7	+ 8.6	327	301	+ 8.6
Oklahoma	512.1	496.9	521.8	— 1.9	15,873	16,176	— 1.9
Pennsylvania	19.3	19.8	27.0	— 28.4	599	836	— 28.4
South Dakota	0.1	0.1	.....	.....	3	.....	.....
Tennessee	0.1	0.1	0.1	— 50.0	1	2	— 50.0
Texas	2,913.8	2,702.9	2,621.5	+ 11.1	90,327	81,266	+ 11.1
Dist. 1—South Central	46.7	46.3	39.9	+ 17.2	1,448	1,236	+ 17.2
Dist. 2—Middle Gulf	157.4	145.1	141.2	+ 11.4	4,879	4,379	+ 11.4
Dist. 3—Upper Gulf	471.0	438.9	441.2	+ 6.8	14,600	13,676	+ 6.8
Dist. 4—Lower Gulf-S.W.	257.9	239.6	246.7	+ 4.6	7,994	7,646	+ 4.6
Dist. 5—East Central	50.9	43.4	45.1	+ 12.8	1,579	1,400	+ 12.8
Dist. 6—Northeast	369.2	334.7	348.2	+ 6.0	11,445	10,794	+ 6.0
Dist. 7-B—North Central	140.8	129.5	121.5	+ 15.9	4,365	3,767	+ 15.9
Dist. 7-C—West Central	183.9	179.3	177.1	+ 3.9	5,703	5,490	+ 3.9
Dist. 8—West	961.0	869.4	839.2	+ 14.5	29,791	26,014	+ 14.5
Dist. 9—North	189.8	192.5	184.8	+ 2.7	5,883	5,729	+ 2.7
Dist. 10—Panhandle	85.2	84.1	78.6	+ 8.4	2,640	2,436	+ 8.4
Utah	6.0	5.3	4.6	+ 29.9	187	144	+ 29.9
Virginia	0.1	0.1	.....	.....	3	1	+200.0
West Virginia	6.6	7.1	8.6	— 22.6	206	266	— 22.6
Wyoming	271.0	267.0	242.8	+ 11.6	8,399	7,527	+ 11.6
Total United States	6,665.2	6,357.6	6,240.4	+ 6.8	206,620	193,453	+ 6.8









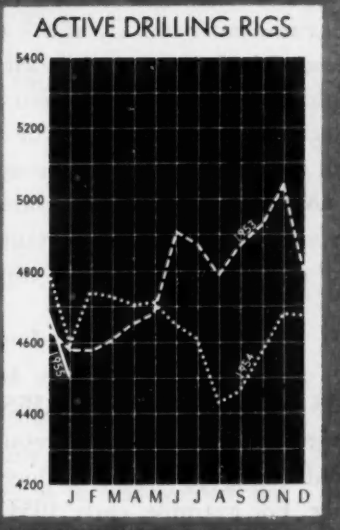
- **Crude output at all-time peak**
- **Oil imports also at new level**
- **Drilling activity eased slightly**

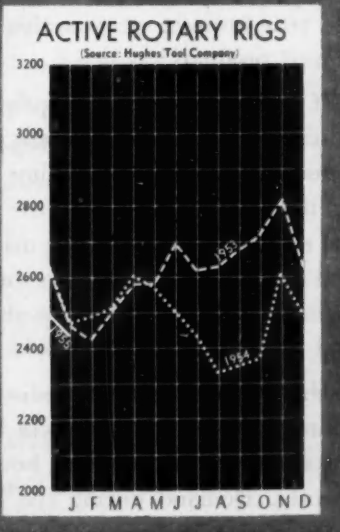
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1952:											
December	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January	6,555	7,042	272,250	3,384	150,518	1,528	80,655	1,307	45,910	616	1,135
February	6,562	6,969	273,589	3,379	157,873	1,505	67,167	1,275	44,178	586	1,066
March	6,531	7,002	275,665	3,319	162,731	1,489	59,802	1,256	41,600	655	1,112
April	6,446	6,781	280,487	3,282	158,032	1,424	61,349	1,219	39,572	628	1,010
May	6,390	7,002	280,308	3,459	156,415	1,400	73,706	1,197	41,795	703	1,096
June	6,595	7,081	283,715	3,467	146,196	1,462	84,504	1,238	43,801	707	1,050
July	6,603	7,103	284,976	3,583	143,916	1,441	102,394	1,224	47,966	629	946
August	6,583	7,163	285,352	3,592	146,050	1,437	119,542	1,222	50,007	672	946
September	6,557	7,023	289,614	3,521	144,184	1,448	126,709	1,203	50,516	692	1,013
October	6,262	6,872	287,541	3,437	144,495	1,462	135,409	1,184	50,820	639	990
November	6,277	6,987	283,021	3,528	150,747	1,463	133,381	1,223	51,267	648	1,120
December	6,238	6,964	276,676	3,628	159,949	1,441	111,944	1,247	49,370	598	1,121
1954:											
January	6,240	6,947	270,811	3,431	171,704	1,550	81,044	1,271	47,474	617	1,143
February	6,379	7,068	266,918	3,476	179,950	1,545	70,390	1,241	47,119	621	1,144
March	6,507	6,923	271,867	3,375	181,297	1,458	60,270	1,168	44,249	654	1,088
April	6,615	6,811	280,310	3,404	177,006	1,374	61,721	1,140	44,362	574	950
May	6,471	7,038	282,250	3,482	177,606	1,372	73,581	1,148	47,009	708	1,021
June	6,500	6,947	285,155	3,483	165,404	1,399	86,325	1,123	50,216	624	999
July	6,242	6,916	284,894	3,480	158,010	1,416	101,657	1,089	54,365	724	1,038
August	6,168	6,862	281,043	3,492	153,168	1,453	117,579	1,069	56,332	664	966
September	6,151	6,939	274,608	3,511	150,916	1,514	128,061	1,086	56,702	672	999
October	6,135	6,834	269,442	3,457	149,661	1,545	139,128	1,066	56,541	642	1,065
November	6,346	6,975	266,616	3,530	150,604	1,622	133,886	1,120	54,891	636	1,104
December	6,357	7,203	261,486	3,536	157,228	1,651	109,631	1,138	51,361	701	1,240
1955:											
January	6,665	7,343	259,828	3,534	170,349	1,743	86,019	1,218	48,236	720	1,304
Jan. 1955 Change:											
In Month	+11	+140	−1,658	−2	+13,121	+92	−23,612	+80	−3,125	+19	+64
In Year	+425	+396	−10,983	+103	−1,355	+193	+4,975	−53	+762	+103	+161
Week Ended:											
2-11-55	6,719	7,384	260,813	3,601	174,203	1,794	76,158	1,238	46,689	811	1,349
2-12-54	6,322	7,030	266,359	3,405	174,017	1,519	73,257	1,214	45,921	638	1,082

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

Lower Producing-Refining Rates Needed

THE ECONOMIC OUTLOOK of the U. S. oil industry for the remainder of 1955 depends on producing, importing and refining levels during the next few months. Substantial reductions from recent high volumes are necessary if excessive stocks are to be avoided next summer.

The industry's position at the end of February is good, but can change quickly at this time of the year. Increased demand in January and February kept the exceptionally high level of operations from having too much adverse effect. However, demand will turn downward in March, and continue downward through April and May. This is a normal seasonal trend. Unless supply volumes are reduced during the next several months, smaller demand will result in the creation of excessive inventories.

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EXCESSIVE INVENTORIES in the summer months of recent years have been the result of failure to reduce U. S. production, imports and refinery runs early enough in the year. For example, early 1954 crude oil production was above needs, reaching a peak in April of nearly 400,000 barrels per day above January. Refining levels also were above needs during the first half of the year. The high level of supply during the low demand second quarter of the year brought on excessive stocks of both crude and refined products.

If the industry acts promptly it can avoid repeating the mistakes it has made in recent preceding years. Failure to reduce operations at this time can only make larger reductions necessary later in the year. This would increase the economic hardships for many producers and refiners, and create a danger of price cuts. The outlook, therefore, dictates lower operating levels by producers, importers and refiners at once.

Unless operations are reduced substantially during March, sizable additions will be made to stocks during the month. April and May, however, are the most critical months. Demand during the latter two months will be smaller because consumption will be light for both heating oils and gasoline.

SUBSTANTIAL REDUCTIONS are necessary. Demand in May or early June may be as much as 1½ million barrels per day below the average for January and February.

Crude production, refinery runs and imports so far in 1955 have been in excess of all past levels. U. S. crude production during the first six weeks of 1955 averaged nearly 6,700,000 barrels daily, almost 400,000 barrels per day above 1954 rates for the same period. Meanwhile, imports during the first six weeks in 1955 were 150,000 barrels per day above 1954, with crude accounting for 100,000 barrels of the increase. Record runs to refinery stills of 7,356,000 barrels per day during the first six weeks of 1955 were 360,000 barrels more than during 1954.

These operating rates were too high, although demand in January was at an all-time high of approximately 9,400,000 barrels daily. However, this was only 400,000 barrels above 1954 rates. Cold weather continued to keep demand at high levels during early February. Nevertheless, refining output was so large that stocks of the four principal refined products were 5,600,000 barrels more than a year ago by mid-February, although they had been 6,000,000 barrels less than 1954 volumes at the start of 1955.

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STOCKS ARE NOT YET in serious shape. Gasoline, distillate, kerosene and residual fuel are each only slightly above year ago levels. However, low demand during the next several months will cause them to become critical if the industry delays curtailment of its producing, refining and importing rates. Unless producers, importers and refiners all curtail their operations during the next three to four months, the industry again will be troubled with excessive inventories.

Mr. H. was excited. He had the oil deal to end all deals. And he was no child when it came to such oil deals. It was a good deal. Mr. H. believed in its success for he had unbounded faith and optimism in his own ability to make it come out as he had planned. He had everything ready for us, and we could hardly keep him from signing right there and then.

We tried to slow him down, but he had the bit between his teeth and he was on the run. Finally we got him to listen, and we explained his deal to him from our point of view. We showed him the dangerous position he was needlessly putting himself in. Our faith in him was high, but we couldn't see a man put a noose around his own neck.

So we knocked off a lot of what he would have had to do. We brought his part down to what you could reasonably expect a man to do. We didn't lend him as much as he had wanted, but what we did lend him was fully adequate and on terms a great deal easier and more favorable to him than he had set up for himself.

We can do things like that because we know the oil business and we know the money business. Our advice is impartial and is based on a great deal of experience. So the chances are we can help you, too. That's why oil men ***going up*** come to the Oil Loan Department of The National Bank of Commerce.

E. O. BUCK, VICE PRESIDENT, OIL LOAN DEPARTMENT

THE NATIONAL BANK OF COMMERCE

OF HOUSTON

Gulf Building, Houston, Texas "The Bank for All the People"

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Facilities of the Oil Loan Department of The National Bank of Commerce are available in Wyoming, Colorado, Nebraska, New Mexico, Texas, Louisiana, and Mississippi.

U. S. Wells Completed During January, 1955

STATE or DISTRICT	NEW WELLS COMPLETED AND FOOTAGE DRILLED												Rigs in Operation		
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New Wells Jan., 1955	Total New Wells Dec., 1954	Total New Wells Jan., 1954	Percent Difference From Year Ago	FOOTAGE January, 1955	FOOTAGE January, 1954	Jan., 31, 1955	Dec., 31, 1954	Jan., 31, 1954
Alabama	....	....	....	6	....	....	....	6	2	3	+100.0	28,321	14,246	3	9	7
Arizona	....	....	....	4	....	....	....	4	1	....	.....	16,136	.....	1	1	2
Arkansas	25	....	1	16	....	....	....	42	48	46	— 8.7	165,909	141,210	32	33	41
California	119	....	2	43	....	....	....	164	212	228	— 28.1	812,674	981,473	241	245	238
Colorado	26	....	6	77	....	....	....	109	134	97	+ 12.4	574,181	541,480	72	82	78
Florida	....	....	....	6	....	....	....	6	3	4	+ 50.0	43,516	21,485	2	4	3
Georgia	....	....	....	....	....	....	....	....	....	1	—100.0	.....	4,264	....	....	2
Idaho	....	....	....	....	....	....	....	....	....	....	.....	.....	.....	....	1	....
Illinois	171	....	....	131	....	....	....	302	337	320	— 5.6	740,595	802,096	277	306	207
Indiana	17	....	2	25	....	....	....	44	77	91	— 51.7	68,870	129,033	97	110	153
Kansas	164	....	29	127	....	....	2	322	421	326	— 1.2	1,173,049	1,147,834	460	478	406
Kentucky	45	....	16	45	1	....	....	107	110	108	— 0.9	177,739	206,882	94	92	86
Louisiana	218	23	25	85	....	....	....	351	328	296	+ 18.6	2,073,459	1,988,692	309	294	225
North Louisiana	135	6	17	40	....	....	....	198	176	141	+ 40.4	570,641	429,146	59	55	47
South Louisiana	83	17	8	45	....	....	....	153	152	155	— 1.3	1,502,818	1,559,546	250	239	178
Maryland	....	....	....	....	....	....	....	....	....	....	.....	.....	.....	3	3	3
Michigan	17	....	3	36	....	....	....	56	49	61	— 8.2	163,091	145,538	76	96	92
Mississippi	10	1	....	20	....	....	....	31	55	21	+ 47.6	231,208	144,430	45	42	26
Missouri	....	....	....	5	....	....	....	5	....	3	+ 66.6	3,335	2,733	2	4	1
Montana	12	....	....	16	....	....	....	28	35	64	— 56.3	136,857	231,073	39	51	30
Nebraska	15	....	....	28	....	....	....	43	61	37	+ 16.2	234,577	207,993	32	34	21
Nevada	....	....	....	1	....	....	....	1	1	....	.....	10,183	.....	3	6	4
New Mexico	46	2	23	20	....	....	....	91	102	114	— 20.2	382,171	620,913	120	103	130
New York	15	....	....	....	11	....	....	26	23	72	— 63.9	36,232	99,868	41	40	98
North Dakota	11	....	....	5	....	....	....	16	35	21	— 23.8	118,664	137,511	24	25	24
Ohio	43	....	20	27	....	....	....	90	84	68	+ 32.4	200,131	136,582	201	196	191
Oklahoma	366	5	11	167	1	....	3	533	756	686	— 19.4	1,927,459	2,407,234	655	675	678
Oregon	....	....	....	....	....	....	....	....	....	....	.....	.....	.....	1	1	....
Pennsylvania	20	....	13	3	17	5	....	58	58	104	— 44.2	103,951	175,822	116	112	244
South Dakota	....	....	....	2	....	....	....	2	1	2	.....	6,752	9,594	2	1	3
Texas	932	41	48	525	14	....	3	1,563	1,816	1,556	+ 0.4	6,792,452	7,252,354	1,286	1,371	1,261
Dist. 1: South Central	97	....	....	40	....	....	....	137	146	69	+ 98.6	337,918	220,605	53	48	26
Dist. 2: Middle Gulf	20	8	5	30	....	....	....	63	63	86	— 26.8	395,321	517,341	32	35	35
Dist. 3: Upper Gulf	64	13	2	63	....	....	1	143	163	134	+ 6.7	928,673	924,511	117	132	111
Dist. 4: Lower Gulf-S.W.	47	13	5	47	....	....	....	112	109	134	— 16.4	628,416	691,168	73	71	76
Dist. 5: East Central	9	....	....	15	....	....	....	24	62	15	+ 60.0	117,089	57,984	13	19	6
Dist. 6: Northeast	21	5	....	17	....	....	....	43	103	48	— 10.4	245,368	309,253	51	50	56
Dist. 7-B: North Central	142	....	6	118	1	....	1	268	331	264	+ 1.5	821,153	900,935	140	155	143
Dist. 7-C: West Central	70	....	1	37	....	....	....	108	107	142	— 24.0	559,317	698,260	134	139	146
Dist. 8: West	222	....	2	52	2	....	....	278	293	262	+ 6.1	1,524,573	1,612,285	369	401	309
Dist. 9: North	183	....	9	98	11	....	....	301	358	308	— 2.3	949,185	1,012,497	236	242	257
Dist. 10: Panhandle	57	2	18	8	....	....	1	86	81	94	— 8.5	285,439	307,515	68	79	96
Utah	2	....	....	7	....	....	....	9	6	4	+125.0	42,031	24,271	16	23	20
Washington	....	....	....	....	....	....	....	....	....	....	.....	.....	.....	....	....	1
West Virginia	5	....	50	8	....	....	....	63	59	37	+ 70.3	166,554	101,003	170	166	198
Wyoming	35	....	4	30	....	....	....	69	59	124	— 44.4	371,427	609,119	72	76	124
Total United States	2,314	72	253	1,465	44	5	8	4,161	4,873	4,494	— 7.4	16,801,524	18,284,733	4,502	4,680	4,597
Total Western Canada	137	....	9	37	....	....	....	183	302	169	+ 8.3	748,031	693,859	194	181	153

January Wells Fall Off

4161 total still ahead of 1953. Prospects of overhauling record 1954 pace bright.

WELLS COMPLETED during January failed to match those recorded in January of last year which had set a new record for wells in an initial month. However, January's tests topped the 1953 mark and were considerably above average for a year's opening.

A total of 4161 new wells was recorded in January compared with 4494 completed in the same period of 1954 and 3916 in 1953. However, there seemed to be an unusually large number of wells in the testing stage at month's end and the deficit from a year ago should be wiped out in a few months. Actually, there were some fewer rigs working at the end of the month than were busy a year earlier, but that was true almost throughout 1954 and the results were more wells drilled. The remarkable progress in faster penetration rates made this possible, and even more gains will probably be seen as this year's operations advance.

It is quite possible that the year's work will be done with fewer drilling rigs than were used in 1954 and still top the all-time high level in wells drilled in that period. That possibility is indicated by the steady improvement in machines, men, and techniques since the end of World War II. In 1954, each rig on the average drilled a total of 45,200 feet of hole. A year earlier, the average had been 41,478 feet. The 23,231 feet drilled per rig in 1946, the first post-war year, was little more than one-half the 1954 rate.

Total footage recorded in January amounted to 16,801,524 feet. That represented a decline of 8.1 percent from last year's 18,284,733. The shortage in the number of wells was not the whole story in the footage drilled decrease. This year's wells were only 4038 feet deep on the average, while a year earlier each test was taken to an average of 4069 feet.

The national decline in January's wells was reflected in the individual records of the top five drilling states. Texas, No. 1 in the nation, managed a 0.4 percent gain over 1954. Its completions increasing from 1556 to 1563.

DTA Correlates Zones Economically

Differential Thermal Analysis identifies formation zones by determining the mineral composition of cuttings from wells.

By GEORGE B. MANGOLD
Petroleum Engineering Associates, Pasadena, Calif.

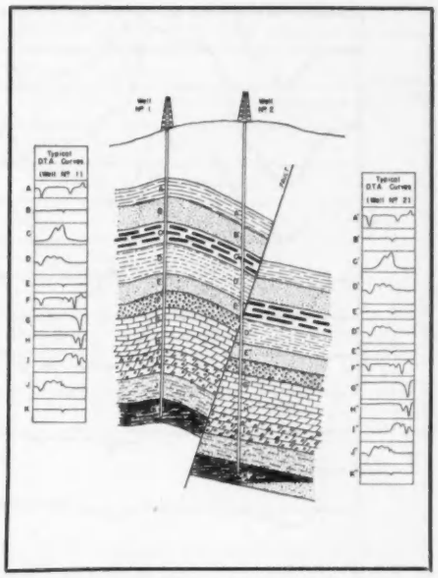

Fig. I—Schematic correlation of zones with differential thermal analysis. Clay, sand, shale, limestone and other zones in Well 1 are correlated with those in Well 2 to show subsurface conditions. Zones are identified in each well by determining mineral composition of cuttings from those zones. Formations indicated: A—bentonitic clay; B—sand; C—lignite; D—shale; E—sand; F—conglomerate; G—limestone; H—dolomite; I—pyrite and dolomite; J—sandy shale, and K—oil sand.
(Repeated from Part 1)

THE ACTUAL procedure of recording the thermal reactions of properly sampled and washed cuttings starts with a thorough drying at a temperature of about 180° F. (80° C.). (Too high a drying temperature may remove characteristic crystalline water dehydration curves.) Samples are then ground to a size of 60-150 mesh and loaded into the multiple sample holder, six at a time. They are simultaneously heated slowly and uniformly from room temperature to at least 1000° C. The differential thermal reactions are automatically recorded throughout this range.

The resultant curves must be corrected as necessary to delete any basic drift of the base lines due to minute differences in thermocouples or imperfections in the sample block and furnace, which have been established beforehand by blank runs. The edited curves are then reduced by pantograph to the convenient size shown in the accompanying illustration, Figure 6, in which a 200-foot section of an actual log is reproduced here in its natural size. The curves are plotted so that their base lines coincide with their correct depth. (It should be noted here that an increment of depth has been added or subtracted to the footage of each section of log or correlation diagram reproduced in this paper in order to maintain the inviolate confidential nature of the particular client's data. Intervals between samples, however, remain as originally determined.) The vertical depth scale is the same as that in common use for electric and radioactivity logs, i.e., 2 in. = 100 feet, so that the logs may be placed alongside one another and conveniently compared, foot for foot. If the samples are obtained at depth intervals of 20 feet or less, the thermal curves provide sufficient continuity and appear in close enough proximity so that visual examination may easily locate formation breaks, compositional trends, and maximum and minimum concentrations of specific minerals.

Whereas experience and training are necessary to identify sample constituents, the human element does not enter into the actual determination of the differential thermal curves. Duplication of curves of samples from separate wells therefore gives indisputable proof of similarity of formations and can form the basis of unquestionable correlation.

The large schematic diagram, Figure 1, shows a number of formation zones of simple composition as well as a fault with accompanying zonal displacement. Two wells are shown penetrating the zones in an unlike manner, and typical DTA curves indicated for each zone in order as penetrated by each well. (Trends and narrow stringers within a zone are here left out for simplicity.) Correlation of the two logs shows that, after passage through the weathered surface soil mantle for which DTA would indicate a somewhat jumbled assortment of clay complexes containing much organic matter, the thermal curves settle down into an orderly progression through the rather well-defined zones, and similarity between the DTA logs of the two wells is at once obvious.

The first five zones could be correlated immediately regardless of the somewhat greater depths for Well 2. Below DTA curve E′ for the latter well, it is apparent that something has happened to change the progression, and an analysis of the remaining portion of the log would show that the zones indicated at Well 1 below E are picked up considerably deeper at F″ for Well 2. From this point down, correlation is again obvious. The experienced observer could then work back up from F″ and would soon notice that DTA curves E″ and D″ are repetitions due evidently to faulting. Thus, the DTA logs of these two wells would not only correlate the formations between them and establish the location of the oil sand but would also indicate presence of a fault and spot the depth at which the fault was crossed. No other correlation device could show this so clearly, if at all.

Carrying this illustration a little further, imagine a well somewhat to the left of Well 1 and beyond a point where zones A and B might have out-

PART 2

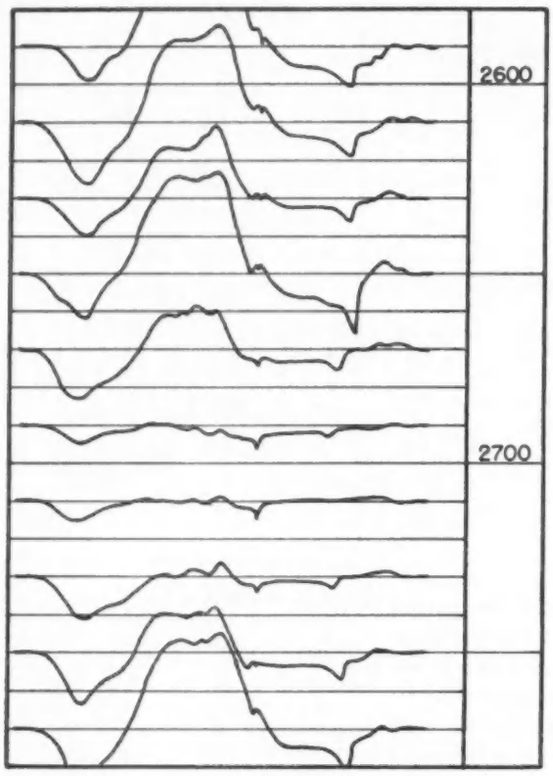

FIGURE 6

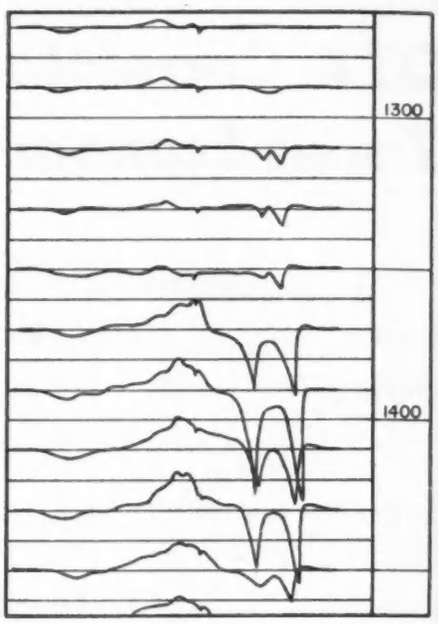

FIGURE 7

cropped. In this case the first well-defined DTA curves after penetration of the soil mantle would be that of zone C, and the correlation with Well 1 would begin with curve C and progress through D, E, F, etc.

Several examples of sections of actual DTA logs are shown here, Figures 6-9, to illustrate types of breaks or changes in formation composition that lend themselves to correlation with logs from other wells. Only the actual depth has been changed as previously noted. The vertical scale is such that one small division equals ten feet. Depth of sample portrayed by each curve is marked by the left end of the curve. The base lines are horizontal. Reactions extending upward are exothermic, downward endothermic. Approximately 1000° C. is represented by the horizontal extent of the curves, from room temperature at the left to maximum temperature at the right.

Figure 6 portrays a narrow sand zone cutting through a thick shale. The relatively flat curves at 2690 feet and 2710 feet with a sharp quartz peak at 573° C. (small endothermic peak just to the right of the center) represent sand. Shales containing considerable carbonaceous matter are shown by the curves above and below, with endothermic water dehydration peaks at the left and large broad exothermic peaks at medium temperature. Small amounts of calcite or limestone appear as endothermic peaks at high temperature.

Figure 7 portrays a sand-to-shale break in which a strong dolomite marker appears, as shown by the double endothermic high-temperature peaks. A small concentration of the dolomite transcends the break, becoming of high concentration in the shale section. Below 1430 feet the dolomite dies out but the shale continues.

Figure 8 shows a sharp break between two types of shales. The upper curves (above 3675 feet) portray a complex similar to the shale in Figure 6 while the curves below 3675 feet represent a pyritic shale of vastly different composition. Breaks of this type usually cannot be picked up by electric or radioactivity logs nor as a rule by paleo. Indeed, it is not possible as yet to completely identify the composition of these shales by DTA. But the break is obvious and similar thermal contours from another well could lead to a definite correlation.

Paleontological examination showed the boundary between two ages of geologic formation on a particular well at about 2275 feet. The DTA log, of which a portion is shown is Figure 9, agreed precisely. Above this depth, quartz, dolomite, and shale appear. Below this depth, an entirely new composition is indicated which contains a high concentration of pyrite, as evidenced by the broad high-temperature exothermic reaction.

In Figure 10 are shown the results of a four-well correlation program which was used as a test of DTA in comparison to paleo methods. Samples were available at 30-foot intervals only—50 percent greater than what has generally been found to be the maximum satisfactory interval. Without knowledge of a single fact concerning the spacing of the wells, geologic features of the area, surface elevations, or information from any other type of log, the thermal curves were determined and the resultant logs correlated. Wells 1 and 2 had a very apparent correlation with many check points. Wells 3 and 4 correlated well in the lower portion. Because of the short overlap between the shallower wells and the deeper ones, only one fairly good DTA marker was found to complete the correlation.

A number of the correlation points were then plotted in Figure 10 and joined by solid lines as shown. Only then were the paleo correlations re-

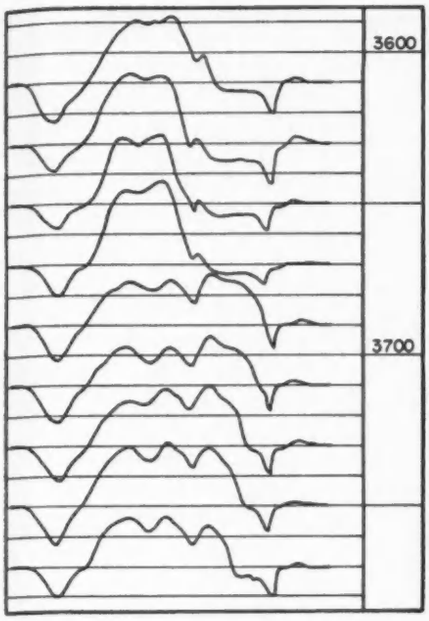

FIGURE 8

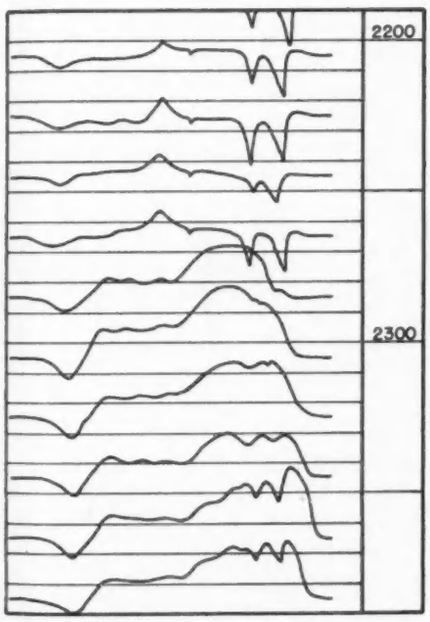

FIGURE 9

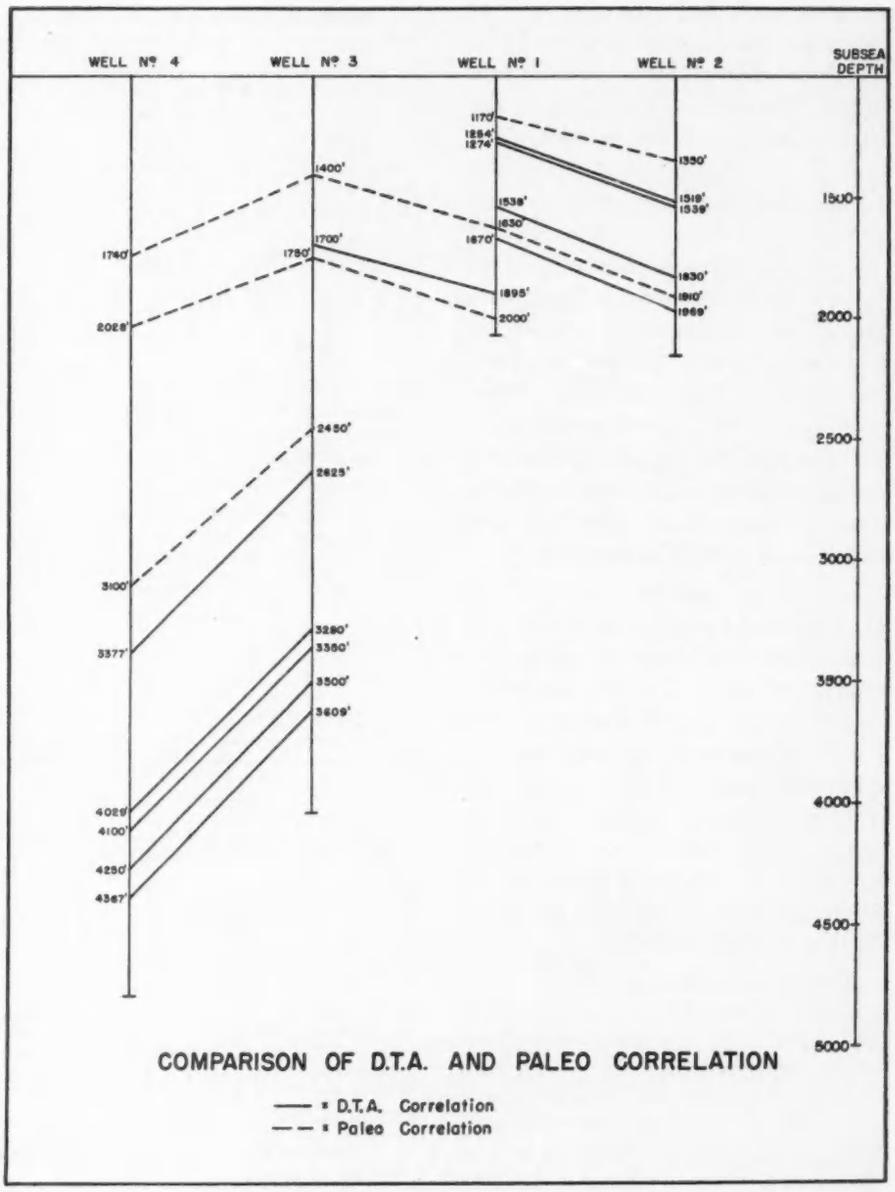

FIGURE 10

ceived, and these were plotted as the dashed lines. The result was an almost perfect agreement between the two methods. It is interesting to note that on Wells 3 and 4, paleo correlations were possible only in the shallower depths. In contrast, DTA correlation was not too obvious at these depths but was very apparent through the deeper zones. The over-all picture clearly indicates a gradually increasing dip between these two wells.

This particular correlation example brings out two points which might be of added interest to the operator. These samples had been procured at a time considerably prior to their use for DTA. Cuttings or cores may be taken during drilling, preferably washed, and then stored almost indefinitely until such time as DTA correlation may be desired. If washing is done after storage, the required soaking may result in loss of clays that might have been distinguished from the drilling mud and retained, had the washing been carried out before the samples were allowed to dry. A second point is that the operator can procure the samples himself — provided the proper techniques are observed—and submit them if and when he wishes DTA. The quantity of sample required is only a few grams (DTA can be determined on as little as 0.5 g.), and such samples can be conveniently cataloged and stored. It should be emphasized, however, that DTA results can be no better than the quality of the samples, and unless the operator is fully aware of the various sampling requirements he will be better off if he delegates this work to technicians trained in the proper techniques.

A sufficient number of wells have now been logged by DTA to prove the value of the method and the great potential it has. No claim is made that it will work in all cases. As with paleo, many sections of formation are unproductive of markers. Fortunately, however, it is rather unlikely that both

methods would fail to be diagnostic at the same time, and quite often DTA will work when all other methods fail. In time it is believed that geologic age of rock formations can be recognized from the thermal curves. As more and more sections are logged, this becomes increasingly evident. At the time of this writing the top of one layer of sediments representing a particular geologic age has been clearly traced in two wells over 150 miles apart! Naturally this will not always be possible because of local erosion and deposition factors, but the potential is there and as equipment and techniques are steadily improved, we come closer and closer to these correlation goals.

Finally, it must be realized that DTA can be of great value in addition to and over and above its use in correlation of zones. Unique properties, as determined by core analysis, of thin layers or particular portions of an otherwise similar cored section, can often be explained from a study of the DTA curves. Unusual formation resistivities can frequently be accounted for by mineral composition indicated by the thermal curves.

This is illustrated in Figure 11 in which are presented core analysis data and differential thermal curves at intervals of 1 foot over an 11-foot core section. Though the samples were quite similar visually, there was considerable variance in resistivity and in permeability. High resistivity at 8247 feet and 8248 feet is seen to be at least partly attributable to the high dolomite content of these two samples. On the other hand, a trace of pyrite at 8254 feet leads to a low resistivity value. All data for 8249 feet and 9250 feet are quite different from those of the two dolomite-bearing samples and the strong calcite-bearing 8251 feet, yet compare closely with values for the similar curves at 8255 feet and 8256 feet. Thus, though much or most of core analysis data is the result of particle size and shape, surface characteristics, and formation fluids, the mineral compositional changes indicated by DTA can frequently explain some variations in these data.

In a similar manner, peaks or "kicks" on the electric log or the radio-activity log can often be accounted for by DTA. As an example, Figure 12 portrays both DTA and

THERMAL CURVE	DEPTH (ft)	POROSITY	K_{air}	$K_{s.w.}$	K_{oil}	RESISTIVITY	D.T.A. CHARACTERISTICS
	8247	10.2	1.4	0	0	40.7	Strong dolomite
	8248	10.6	0.3	0	0	46.2	Strong dolomite
	8249	15.7	8.9	7.8	7.2	36.3	Only trace of carbonate More shale
	8250	17.0	20.	14.	9.4	36.3	Same as 8249'
	8251	12.8	1.5	0	0	31.7	Strong calcite
	8252	16.8	24.	25.	13.	28.6	
	8253	14.6	1.2	0	0	29.1	
	8254	17.2	3.2	1.9	0	18.5	Trace of pyrite
	8255	16.6	14.	13.	7.1	26.1	Strong quartz Weak shale
	8256	14.6	16.	15.	7.3	24.5	Same as 8255'
	8257	16.0	3.7	3.6	0	20.9	No carbonate

FIGURE 11

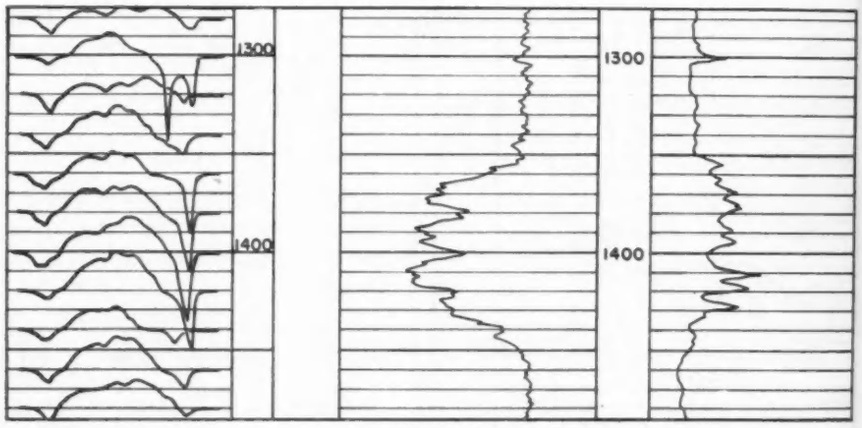

FIGURE 12

electric log curves of a 200-foot section. The single resistivity peak at 1300 feet corresponds exactly with the dolomite stringer shown by the thermal curve. At a lower depth, the calcite or limestone section similarly corresponds with the electric log. Through this type of correlation, it is believed that zones erroneously logged as oil sands, or oil-bearing formations that are missed by logs taken in the hole, may frequently be properly evaluated.

In addition, oddities encountered in drilling, and unusual effects of formation material on drilling fluids or cement, may be subject to explanation on the basis of thermal curves. Solids apparently coming from a producing zone have been successfully correlated with shallower formations to show source opposite a casing defect. Pyrite zones, frequently an indirect cause of corrosion, can be detected with a very high degree of sensitivity by DTA. Because of its simplicity, its varied and tremendous possibilities, and its value as a correlative tool, differential thermal analysis has reached a stature such that progressive petroleum geologists and engineers can hardly afford to pass it up.

ACKNOWLEDGMENT

Acknowledgment is hereby given to Florent H. Bailly, whose foresight, perseverance, and unyielding faith in DTA has enabled his laboratories of Petroleum Engineering Associates, Inc., to carry through the long diligent examination and development of DTA as a great new correlative method for the petroleum industry.

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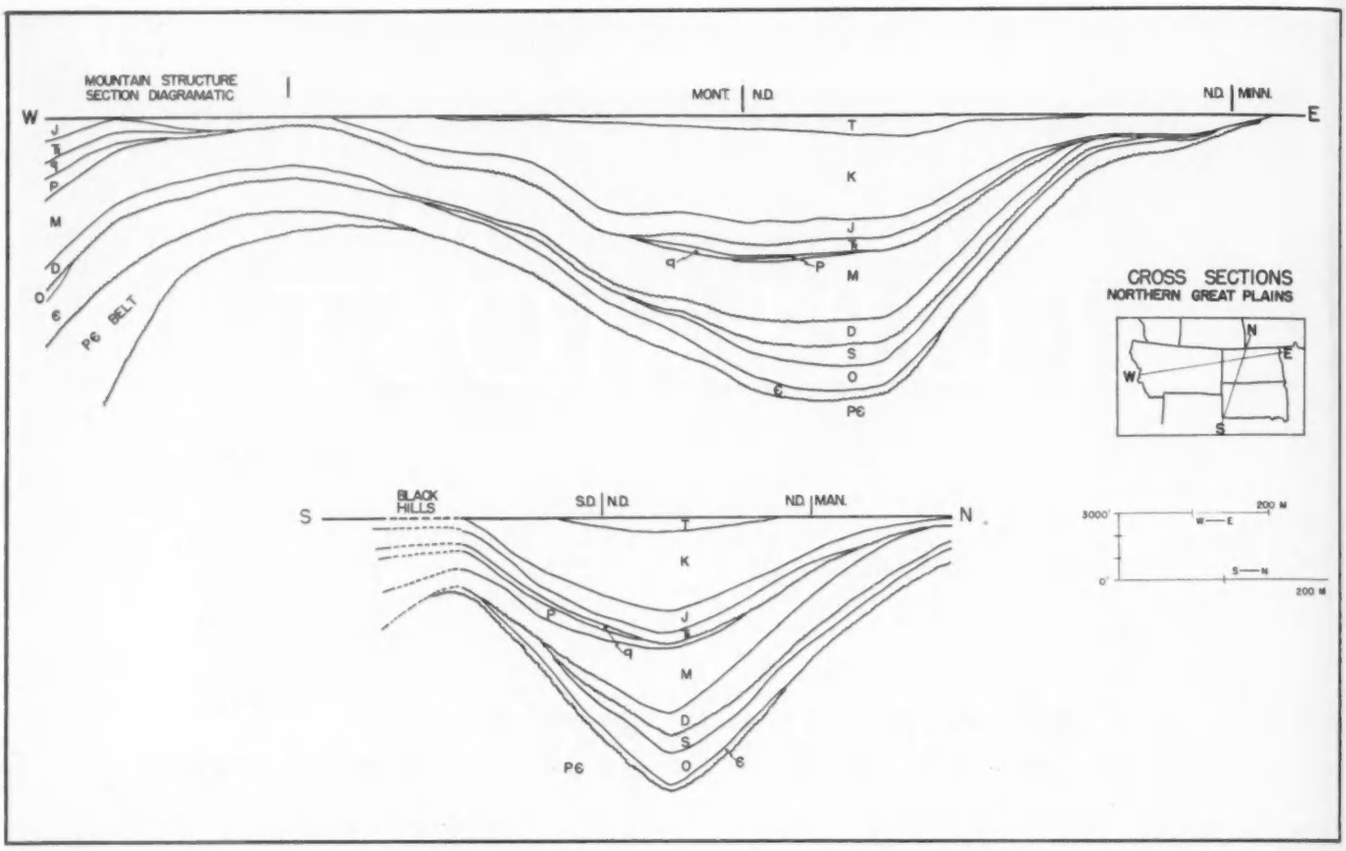


Fig. 1—Cross-sections showing the unconformities, pinchouts and stratigraphic relations in Williston Basin. PC pre-cambrian, C Cambrian, O Ordovician, S Silurian, D Devonian, M Mississippian, P Pennsylvanian, q Permian, TR Triassic, J Jurassic, K Cretaceous, T Tertiary.

Discovery Prospects Good On Williston's East Flank

Oil accumulations are possible in pure stratigraphic traps and also in traps formed by combinations of stratigraphic and structural conditions.

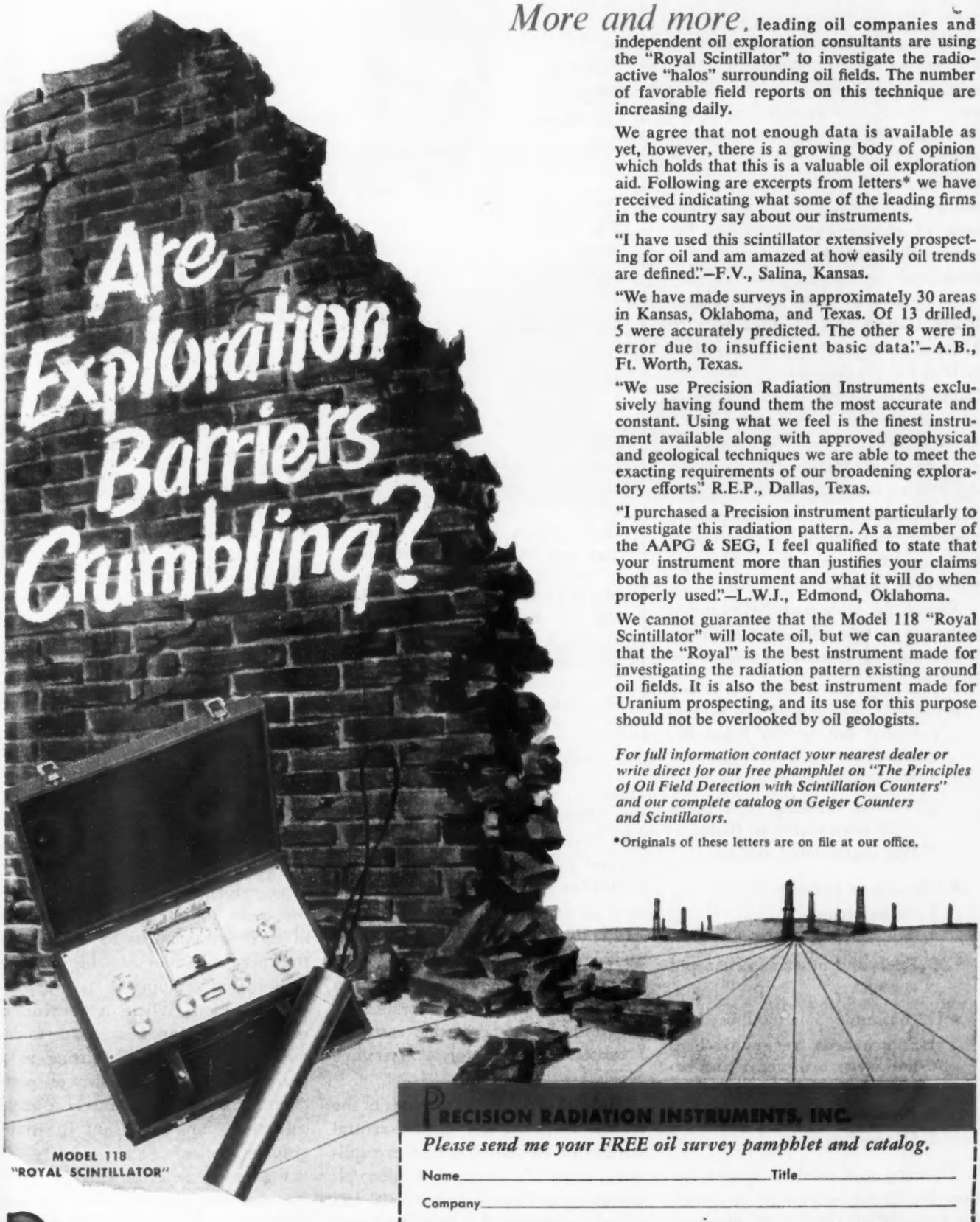
By WILLARD D. PYE, Consulting Geologist, Fargo, N. D.

THE EASTERN SIDE of the Williston Basin contains a wide variety of stratigraphic and structural-stratigraphic types of traps at shallow depths. That oil is present in some of these traps is indicated by the presently producing oil fields, which are at least partly stratigraphic in nature, in both Manitoba, Canada, and north-central North Dakota.

A number of factors favoring stratigraphic oil accumulation are found on the eastern flank of the Basin. However, of even greater importance are the structural-stratigraphic trap combinations. These favorable conditions, as well as the shallow depths at which they lie, have intensified the search for oil along the eastern margin. The principal problem involved is localizing the position of the stratigraphic traps. Core drilling, exploration drilling and geophysical work have all been used, and the play on the eastern side of the basin is in contrast to the oil exploration work in the deeper part, where structural traps are of primary interest.

The deepest portion of the Williston Basin is found in the western part of the Dakotas and in eastern Saskatchewan, Canada, where the sedimentary column is some 15,000 feet thick. Eastward from the axis of the basin, the section progressively thins until it eventually pinches out and pre-Cambrian crystalline rocks are found at the surface or under a shallow glacial drift cover.

Although remnants of Cretaceous beds, which overlap all older sedimentary formations, may be found somewhat to the east, the approximate line of the pinchout of the Cre-



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taceous sedimentary cover diagonals southeastward across Western Manitoba. The line passes a few miles east of Winnipeg, crossing the northwestern corner of Minnesota and then swings slightly west of south until it enters North Dakota somewhat north of Fargo. The pinchout line continues southward to the Sioux Arch in southeastern South Dakota, and there it swings rather sharply westward. The area of stratigraphic traps lies between the deepest portion of the basin and the curving pinchout line.

A number of wells in northern North Dakota and adjacent parts of Manitoba have found oil shows or yielded limited production within this "stratigraphic trap area." However, only the Daly-Virden and Roselea areas of Manitoba can be considered good fields. In these and in some of the north-central North Dakota wells in Bottineau County, the stratigraphic pinchout undoubtedly is important, but some structural control also appears to be present.

The stratigraphic trap environments along the eastern side of the Williston Basin can be classified as traps related to:

- General thinning of the section eastward out of the Basin because of:
  1. Non-deposition of section.
  2. Natural thinning of deposits away from center of Basin.
  3. Post-depositional erosion.
- Changes in porosity due to:
  1. Facies changes.
  2. Secondary porosity.
  3. Reefs and other miscellaneous causes.
- Unconformity relationships:
  1. Source beds, reservoir beds and cover beds above and below the unconformity.
  2. Residual erosional remnants.
  3. Channel deposits.

Thinning as a result of loss of section due to non-deposition is found, for example, in the Upper Mississippian section. Deposition of the Upper Mississippian beds was confined to the central, deeper part of the basin, and no deposits of Upper Mississippian age are found along the eastern side.

About the Author

DR. WILLARD D. PYE of Fargo, N. D., has had a wide experience in theoretical and practical petroleum geology and sedimentation work. A graduate of Oberlin College, Oberlin, Ohio, he obtained his M.S. and Ph.D. degrees from California Institute of Technology and University of Chicago, respectively. After associations with a number of major oil companies and undertaking special work for leading universities and professional groups, he became chairman and professor, Department of Geology and Geography, North Dakota Agricultural College at Fargo. Last year he became a consulting geologist and executive secretary of the Yellowstone-Bighorn Research Association.

However, not all of the thinning of the Mississippian section is due to non-deposition, since erosion and a natural thinning of the beds also accounts for much of the over-all thinning of the interval.

The Cambrian system of rocks is another example where beds are missing as a result of non-deposition. In this case the younger Cambrian beds progressively extend farther eastward because of on-lap onto the crystalline Shield.

Natural depositional thinning of the section eastward out of the central portion of the basin is best exemplified by the Cretaceous section, although post-Cretaceous erosional loss of strata obscure this thinning somewhat. This same eastward trend is found in formations of other periods as the eastern shorelines of the seas are approached or as the eastern limits of sedimentation are neared.

Post-depositional erosion accounts for much of the over-all thinning of the stratigraphic column. Most important erosional interval is the post-Mississippian. In the eastern portion of the basin where only Cretaceous beds cover the eroded edges of the Mississippian formations, the erosional interval lasted from Mississippian to Cretaceous time. Moving westward into the basin, successively shorter intervals of post-Mississippian erosion are found, until in the central portion where Pennsylvanian beds overlie Mississippian beds the erosional interval was very brief. The other marked thinning due to post-depositional erosion is found in the eastward thinning of the thick Cretaceous section.

In the development of stratigraphic traps the post-Mississippian erosional interval is very important. Not important is the post-Cretaceous interval, except where erosion has completely removed the Cretaceous cover beds, so that truncated edges of Paleozoic strata are exposed. In areas where this has happened, such as in Manitoba along the sedimentary margin of the basin, potential Paleozoic-Cretaceous stratigraphic traps are not possible.

Less extensive erosional intervals account for some thinning of the section. These are found between formations of almost every system, and intra-period erosional intervals of considerable magnitude also are present. As the stratigraphic section is more thoroughly determined, more and more of these minor breaks will become evident. A study now in progress seeks to interpret the thickness of each formation as to whether its thickness variations are the result of depositional thinning or post-depositional erosion. Where a section is missing, studies are being made to determine whether it is missing as a result of non-deposition or post-depositional erosion. Answers to these questions are significant in stratigraphic studies.

Figure 1, a cross-section, shows some of the pinchout and thinning relationships between series of rocks in the basin, and exemplifies the preceding discussion.

Figure 2 shows the position of the eastern pinchout of each Paleozoic system of rocks. Details of formation

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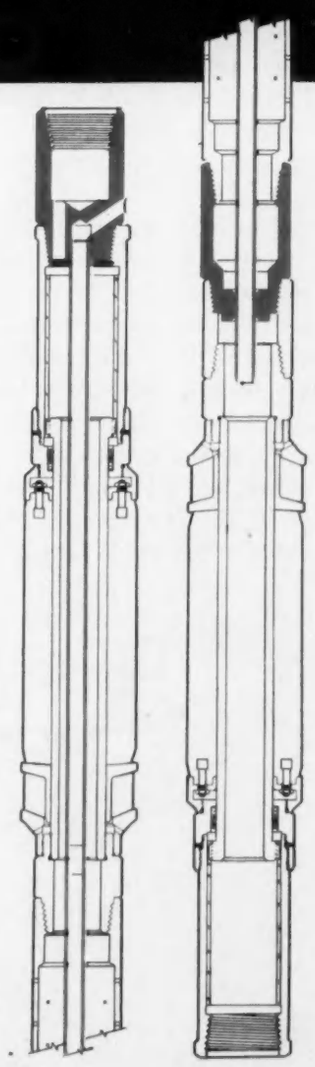

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pinchouts within each system have not been shown. With few exceptions, the present pinchout of a series of beds is the erosional wedge-edge rather than the shoreline edge of the formation.

Lateral changes in the porosity such as the change from a sandstone facies to a shale facies can be found in several horizons. These changes are best exhibited in the lower portion of the Cretaceous section in the eastern part of the basin. In that area the "Lakota" and "Dakota" sandstones can usually be identified. Some well logs record no other sandstone beds, while other well records may indicate the presence of three to five additional sandstone layers. Where control is close, the lenticular character of these layers is readily demonstrated. Unfortunately, these Cretaceous sandstone beds have all been found to be water bearing or devoid of commercial oil or gas, although some attempts have been made to produce gas in the same areas where it has been found in some quantity with the water.

A gradual facies change is found in the lower Paleozoic section, where there is a tendency for the carbonate section to become increasingly sandy southeastward. This facies change, although not abrupt enough to form a stratigraphic trap, is of importance in developing good reservoirs, especially, for example, in the Ordovician section where the Winnipeg sandstone has become a very good reservoir.

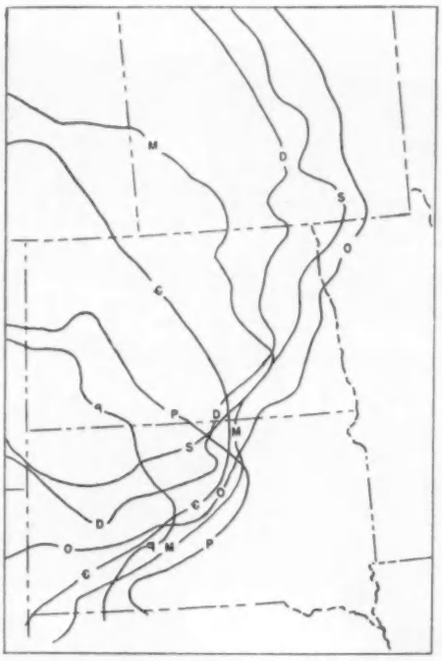

Fig. 2—Pinchouts, overlaps and offlaps of Paleozoic systems of rocks on the east side of Williston Basin. All systems pinchout eastward. C Cambrian, O Ordovician, S Silurian, D Devonian, M Mississippian, P Pennsylvanian, q Permian.

Lenticular changes in porosity are evidenced in some of the carbonate beds, especially in the Mission Canyon and Lodgepole formations of Lower Mississippian age. In these beds secondary porosity has developed. Part of this porosity development may be due to solution during the post-Mississippian erosion interval.

Reefs are present in the area under discussion. They are well exposed in outcrops in the Silurian beds in Manitoba. Most of the exposed reefs are small in areal extent, but they may be quite porous. Reef-like material was found in Silurian beds at the bottom of Amerada Petroleum Corporation's Iverson 1, Section 6-155N-95-W, which discovered oil in North Dakota. Other wells have drilled reef-like structures, and this type of trap must be considered in any stratigraphic play on the eastern side of the basin.

Finally, and perhaps most important, are the traps associated with unconformities. Examples of some types are diagrammatically shown in Figure 3. They can be classified as:

- Traps with reservoirs below the unconformity.
  1. Source of oil from below the unconformity.
  2. Source of oil from above the unconformity.
- Traps with reservoirs above the unconformity.
  1. Source of oil from below the unconformity.
- Traps with reservoirs "within" the unconformity horizon.
  1. Stream channels filled with porous and permeable rock.
  2. Erosional remnants.
     a. Wedge-out of porous beds against flanks.
     b. Detrital wash forming res-

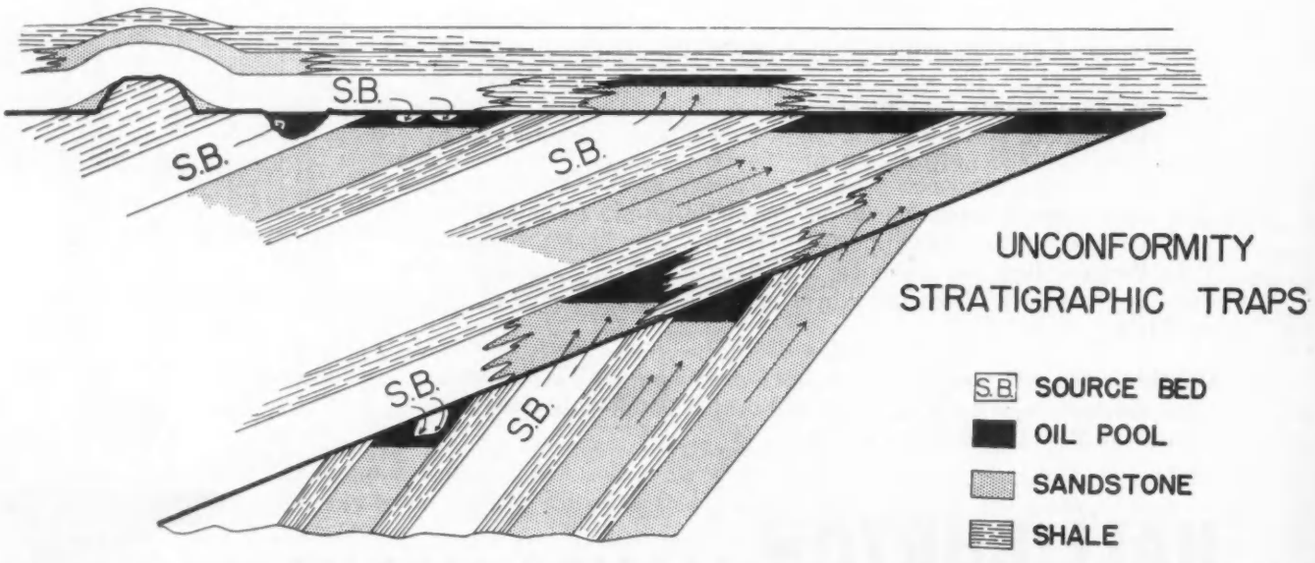

Fig. 3—Diagrammatic representation of various types of stratigraphic traps which may be found associated with unconformities in Williston Basin. Other types are possible and have been discussed in the text. The "sandstone" may be any porous reservoir rock.

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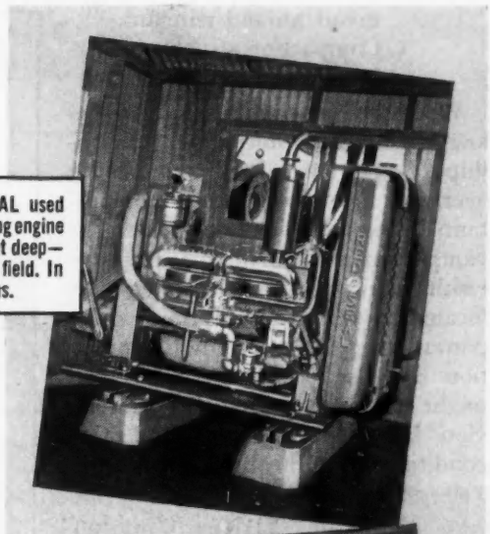

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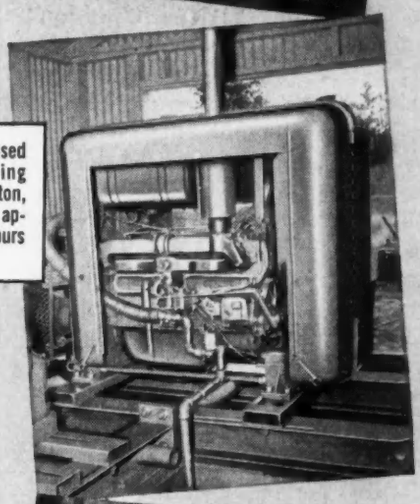

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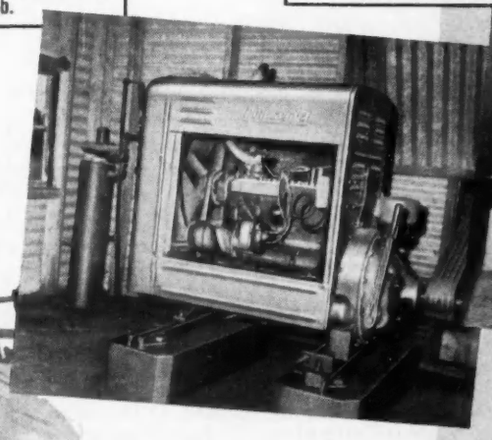

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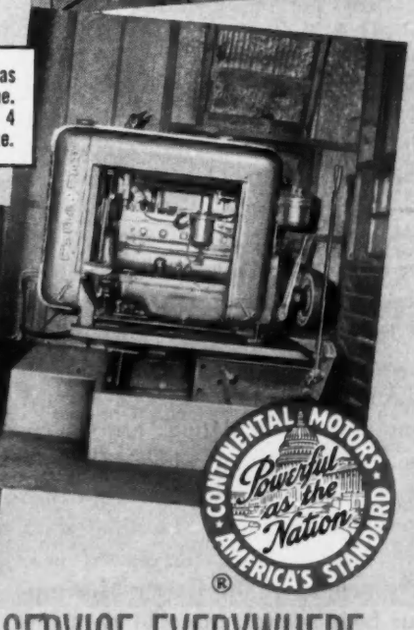

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ervoir around remnant.

c. Compaction structures overlying a remnant core.

Where the reservoir is located below the unconformity, the relationship of the basal beds immediately overlying the unconformity is important. If the overlying beds are impervious, then a satisfactory trap can result. Similarly, if a source bed were located above an unconformity and a porous reservoir bed below it, migration downward into the reservoir might take place provided no impervious layer separated them and other conditions were favorable.

In the second case, where the reservoir is located above the unconformity, if source beds are below it and there is no impervious layer separating the two, migration of oil can be upward into the overlying beds. An example of this type of accumulation is found in the Bottineau County area of north central North Dakota. Here Triassic beds, which normally would not be considered a potential oil horizon, have as their base a porous sandstone. These porous beds overlie truncated Lower Mississippian oil bearing beds. Oil has migrated upward through the unconformity into the overlying Triassic reservoir. Several wells have found saturation in these Triassic beds and some production has been secured therefrom.

If both the source beds and reservoir beds are above the unconformity, then there is merely lateral migration, and the unconformity plays no role. This relationship produces a facies type of trap.

In the third case, if reservoir beds are located "within" the unconformity zone, several possibilities occur. In Figure 3 several illustrations of such traps and accumulations are shown. The records from wells drilled in north central North Dakota and just across the line into Manitoba show erosional hills and valleys and near the pinchout of the Lower Mississippian beds several erosional remnants of Lower Mississippian rocks. A careful study of the records yields a picture of this buried topography developed upon the Mississippian limestones by pre-Triassic erosion. Although no definite stream channel accumulation has been found, certain wells appear low when the area is contoured using the "top of the Mississippian limestone" as the key horizon. In that area this horizon is the erosional Mississippian surface, and irregularities are topographic. In the case of a well in Manitoba, Standard Oil Company of California's Waskada 1, Section 14-1N-26W, it is quite likely that it was drilled in some valley or on an erosional low.

Fig. 4—Formations overlying the Triassic beds. The area occupied by Triassic beds is stippled. On this map lithologies of the overlying beds are omitted. J Jurassic.

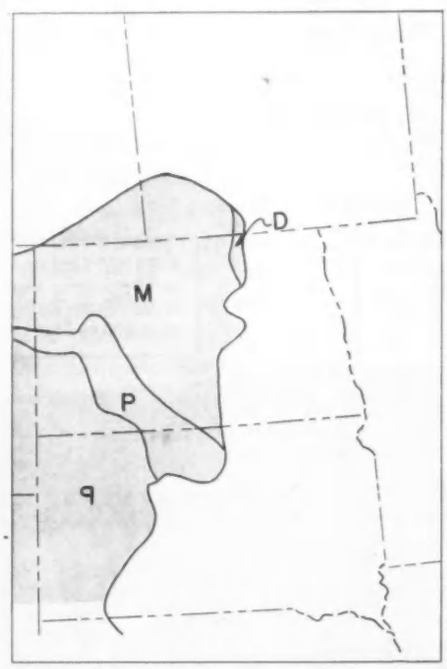

Fig. 5—Formations underlying the Triassic beds. The area occupied by Triassic beds is stippled. On this map lithologies of the underlying beds are omitted. D Devonian, M Mississippian, P Pennsylvanian, q Permian.

Although no production seems to have come from reservoirs strictly related to erosional remnants in the eastern part of the basin, such traps are possible and a number of such prospects have been drilled. It is unlikely that reef structure would be found built upon any of the Mississippian remnants, since they developed in post-Mississippian—pre-Triassic time. However, erosional irregularities which originated from older periods of erosion of some of the older beds might form platforms upon which later reefs might form.

Much geophysical work has been done in various portions of the eastern part of the basin. In some cases mapping has been upon these previously mentioned topographic highs. In some cases the highs were recognized as being of topographic origin, and they were purposely drilled, anticipating stratigraphic or compaction structural oil accumulation; in other cases their topographic nature was not recognized. Reinterpretation of much of the early shooting would doubtless now be valuable in light of the additional knowledge available.

Since, as Figure 3 shows, the relationship of the beds immediately overlying and underlying an unconformity plays a very important role in searching for stratigraphic oil accumulations, maps have been prepared illustrating the relationship of formations for each period. Stratigraphic exploration maps must show in addition to formations boundaries the details of the lithology in the beds immediately underlying and immediately overlying the unconformity. Where there is a proper relationship of source beds, reservoir beds and impervious beds, a potential stratigraphic pool may be expected.

Figures 4 and 5 show simplified versions of maps of the overlying and underlying formational relationships to the Triassic strata. These Triassic beds normally would be considered non-productive. In the eastern portion of the Williston Basin, Jurassic beds everywhere overlie the Triassic formations. Both the immediately underlying Triassic and overlying Jurassic beds are red sandstones, silts and shales. Reservoir beds and impervious beds are present, but there

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with NATIONAL Drill Pipe, Casing, and Tubing

The L.L.&E. #1, a 16,281-foot John W. Mecom-Freeport Sulphur Well in Lake Washington Field, Plaquemines Parish, Louisiana, is the deepest producer on the Grande Ecaille Dome. On a four-hour production test, the well flowed at the rate of 405 barrels of 48-9-gravity condensate daily through a small choke. It made gas at the rate of 1,325,000 cubic feet.

NATIONAL Seamless Drill Pipe was used in drilling the new well to a depth of 16,281 feet, before completion was made. The combination casing string consisted of 5700 feet of 7-inch O.D. NATIONAL (B) Buttress-Thread Casing, 9300 feet of 7-inch O.D. NATIONAL Deep Well Casing, and 1425 feet of NATIONAL N-80 Liner. The 16,257 feet of tubing were NATIONAL Seamless. All tubing in the hole passed Loomis testing during running.

NATIONAL Seamless Oil Country Tubular Products are habitually chosen for the *deep* hole jobs because they promise trouble-free dependability all the way down—even under the most rigorous conditions. The Seamless process of manufacture gives them unsurpassed uniformity and strength, the best defense against fatigue, twisting action, and collapse.

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For complete details on NATIONAL *Seamless Drill Pipe, Casing and Tubing, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.*

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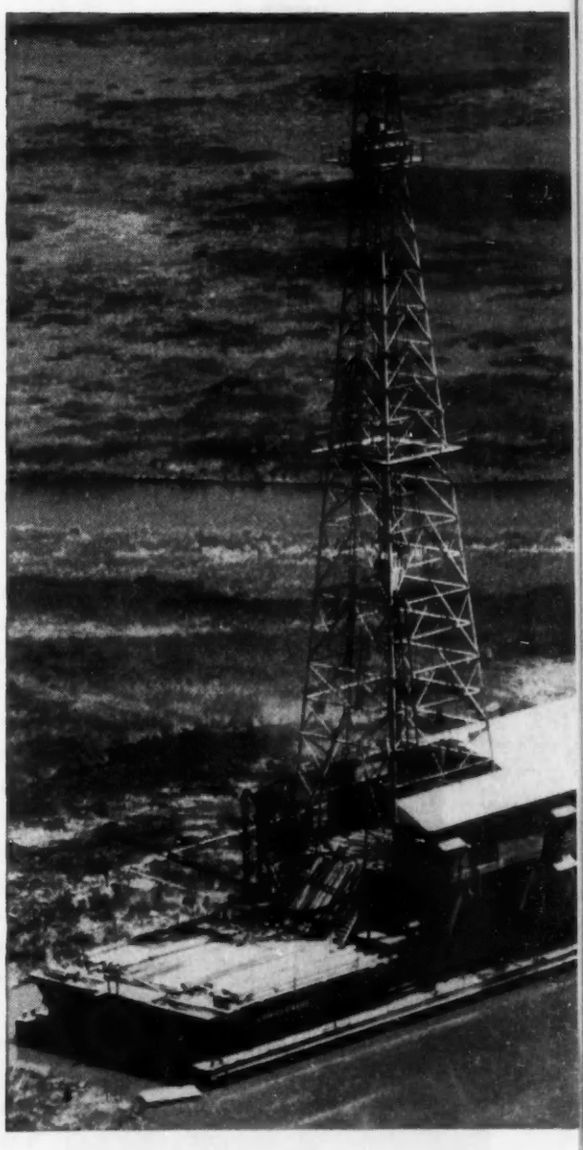

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are no oil bearing or source beds at the unconformity. Evidently the Jurassic-Triassic boundary is no place to look for a stratigraphic oil pool.

Likewise, the basal Triassic beds are sandstones, silts and shales forming reservoir beds and impervious covering beds, but again no source of oil is present in them. However, the Triassic strata successively overlie from west to east Permian, Pennsylvanian, Mississippian, Devonian, Silurian and Ordovician formations. Mississippian and older rocks have yielded production in the Williston Basin. Therefore, anywhere that impervious beds of Triassic age overlap and seal older truncated, porous, oil bearing beds, a stratigraphic trap might be found in the pre-Triassic formation and below the unconformity, assuming other conditions are favorable.

On the other hand, in some areas the lowermost Triassic bed is almost a basal conglomerate or coarse sandstone, and this would form a good reservoir in case it should be superimposed upon an oil "bleeding" edge of older rock. In the Bottineau County area of north central North Dakota such a relationship exists as has been mentioned earlier. There Triassic rocks are saturated and have produced some oil.

By means of detailed stratigraphic exploration maps it is possible to localize the general areas favorable to these unconformity oil accumulations.

This discussion has dealt with almost pure stratigraphic types of oil traps. Fortunately, in eastern North Dakota structures are also present. The relationship of structural and stratigraphic traps in eastern North Dakota has been discussed elsewhere.[1] A structural trap superimposed upon a stratigraphic trap forms an ideal area for stratigraphic exploration in the eastern part of the Williston Basin. Fortunately, the structural and stratigraphic traps tend to cross each other at about right angles. These combination traps are being sought by all available means, and additional drilling will undoubtedly yield more pools in this favorable eastern Williston Basin area.

REFERENCE

[1] Relationship of Oil Accumulation to Paleogeology and Structure in Manitoba and Eastern North and South Dakota; abstract, Rocky Mountain Section, AAPG, Salt Lake City, 1952.

—The End

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Results of Exploratory Drilling, January, 1955, by States

State or District	JANUARY, 1955—54																		
	PRODUCTIVE TESTS											UNPRODUCTIVE TESTS					Total Exploratory Tests	
	New Fields			New Pays			Extensions			Total Productive					Total Dry			
	Oil	Dist.	Gas	Oil	Dist.	Gas	Oil	Dist.	Gas	Jan., 1955	Jan., 1954	Wild-cats	New Pays	Out-Posts	Jan., 1955	Jan., 1954	Jan., 1955	Jan., 1954
Alabama	..	..	..	..	..	..	..	..	..	..	..	6	..	..	6	3	6	3
Arizona	..	..	..	..	..	..	..	..	..	..	..	4	..	..	4	..	4	....
Arkansas	1	..	..	2	..	..	1	..	..	4	1	9	..	1	10	6	14	7
California	..	..	..	2	1	1	1	..	..	5	8	23	..	1	24	25	29	33
Colorado	6	..	3	1	..	1	3	..	..	14	5	58	..	3	61	49	75	54
Florida	..	..	..	..	..	..	..	..	..	..	..	5	..	..	5	4	5	4
Georgia	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1
Illinois	2	..	..	2	..	..	6	..	..	10	20	53	..	..	53	69	63	89
Indiana	3	..	..	..	..	..	..	..	..	3	1	11	..	..	11	27	14	28
Kansas	12	..	5	..	..	..	..	..	..	17	13	62	..	..	62	58	79	71
Kentucky	2	..	..	..	..	..	..	..	..	2	3	7	..	..	7	8	9	11
Louisiana	2	..	..	9	5	1	6	3	2	28	20	34	..	5	39	37	67	57
North Louisiana	..	..	..	1	..	1	2	2	..	6	4	15	..	2	17	9	23	13
South Louisiana	2	..	..	8	5	..	4	1	2	22	16	19	..	3	22	28	44	44
Michigan	1	..	..	..	..	..	..	..	..	1	1	24	..	..	24	28	25	29
Mississippi	..	..	..	2	..	..	..	..	..	2	..	14	..	1	15	7	17	7
Missouri	..	..	..	..	..	..	..	..	..	..	..	5	..	..	5	3	5	3
Montana	1	..	..	..	..	..	1	..	..	2	1	8	..	..	8	12	10	13
Nebraska	4	..	..	..	..	..	..	..	..	4	6	21	..	1	22	8	26	14
Nevada	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	..	1	....
New Mexico	2	1	1	2	..	..	2	..	3	11	4	9	..	1	10	18	21	22
North Dakota	..	..	..	..	..	..	2	..	..	2	1	4	..	..	4	8	6	9
Ohio	..	..	1	..	..	..	..	..	1	2	1	4	..	..	4	1	6	2
Oklahoma	7	2	..	2	..	1	3	1	1	17	25	47	..	2	49	63	66	88
South Dakota	..	..	..	..	..	..	..	..	..	..	..	2	..	..	2	2	2	2
Texas	50	3	9	17	5	..	17	3	1	105	116	339	1	2	342	351	447	467
Dist. 1 South Central	3	..	..	1	..	..	..	..	..	4	5	25	..	..	25	15	29	20
Dist. 2 Middle Gulf	..	1	3	2	..	..	..	..	..	6	3	23	..	..	23	18	29	21
Dist. 3 Upper Gulf	2	1	1	3	3	..	3	2	1	16	16	36	..	2	38	31	54	47
Dist. 4 L. Gulf-S.W.	3	1	1	4	2	..	..	..	..	11	15	34	..	..	34	26	45	41
Dist. 5 E. Central	1	..	..	1	..	..	..	..	..	2	1	9	..	..	9	5	11	6
Dist. 6 Northeast	..	..	..	..	..	..	1	..	..	1	..	11	..	..	11	12	12	12
Dist. 7-B N. Central	15	..	2	1	..	..	4	..	..	22	30	82	..	..	82	98	104	128
Dist. 7-C Central	5	..	1	1	..	..	1	..	..	8	10	26	1	..	27	46	35	56
Dist. 8 West	4	..	..	2	..	..	7	..	..	13	14	37	..	..	37	47	50	61
Dist. 9 North	17	..	1	2	..	..	1	..	..	21	20	55	..	..	55	48	76	68
Dist. 10 Panhandle	..	..	..	..	..	..	..	1	..	1	2	1	..	..	1	5	2	7
Utah	1	..	..	..	..	..	..	..	..	1	2	6	..	..	6	1	7	3
West Virginia	..	..	2	..	..	..	..	..	..	2	..	..	..	..	..	..	2	....
Wyoming	..	..	1	..	..	..	..	..	3	4	9	21	..	..	21	18	25	27
Total U. S.	94	6	22	39	11	4	42	7	11	236	237	777	1	17	795	807	1,031	1,044

Exploratory Drilling Off to a Fast Start

By **CECIL W. SMITH,** World Oil Staff

Exploratory drilling got this year's search off to a good running start during January when a total of 1031 new tests were completed. That was only 13 wells less than the 1044 recorded in 1954's opening month, which was the highest ever attained in any initial period.

However, this year's tests proved to be slightly more successful than last year's counterparts. In January, 13 fewer tries resulted in only one less producing well. That gave the month's exploration a producer-to-failure score of 22.9 percent productive, while the earlier period's efforts were rewarded by a slightly less 22.7 percent.

While January's exploratory drilling varied little from last year's in totals, the type of exploratory wells drilled differed. This year, only 899 rank wildcats were recorded, while a year ago these numbered 954. Off too was the success ratio of this year's wildcatting activity. One hundred and twenty-two wildcats opened new producing fields in January for a score of 13.6 percent, compared with 148 successes or 15.5 percent a year ago.

The seeking of new pay horizons in established fields paid off in exactly the pattern as last year's when 54 were uncovered.

The big difference this year was the efforts to extend known fields. Outpost wells successfully proved major extensions to 60 fields in January, while 36 fields had their producing limits expanded in the opening month of 1954.

Summary of Results of Exploratory Drilling

ITEM	Jan., 1955	Dec., 1954	Jan., 1954	% Diff. Jan., '54-'55
Oil Discoveries	133	150	153	— 13.1
New Fields	94	98	112	— 16.1
New Pays	39	52	41	— 4.9
Distillate Discoveries	17	25	19	— 10.5
New Fields	6	9	10	— 40.0
New Pays	11	16	9	+ 22.2
Gas Discoveries	26	31	30	— 13.3
New Fields	22	26	26	— 15.4
New Pays	4	5	4	.....
Total Discoveries	176	206	202	— 12.9
Extension to Fields	60	53	35	+ 71.4
Oil Fields	42	39	28	+ 50.0
Distillate Fields	7	5	1	+600.0
Gas Fields	11	9	6	+ 83.3
Total Production Tests	236	259	237	— 0.4
Dry Holes	795	952	807	— 1.5
Wildcats	777	939	806	— 3.6
New Pays	1	.....	.....	.....
Outposts	17	13	1	.....
Total Exploratory Tests	1,031	1,211	1,044	— 1.3
Percent Productive	22.9	21.4	22.7	.....
Percent Dry	77.1	78.6	77.3	.....

U. S. Discoveries in January

NEW FIELDS, NEW PAYS AND EXTENSIONS

ARKANSAS—NEW OIL FIELD

Lafayette County. C. G. Davis & Guy R. Smith's C. B. Knighton 1, C SE SE NW 35-15s-23w, pumped 40 barrels from Tokio sand, Upper Cretaceous 2464-68 and 2472-75 feet, 14.7-gravity, completed 1-20-55, TD 4007.

ARKANSAS—NEW OIL PAYS

Lafayette County, Kiblah field. Deep Rock Oil Corp's Doles Heirs 1, C SW SE 27-19s-26w, flowed 40 barrels oil and 10 barrels water from Hill sand, Lower Cretaceous 5869-71 feet, ⅛-inch, 35.5-gravity, completed 1-12-55, TD 7100.

Union County, Hibank field. E. G. Bradham's Patterson Unit 1, C NW SE 19-18s-14w, pumped 40 barrels oil and 40 barrels water from Glen Rose sand, Lower Cretaceous 3462-70 feet, 26-gravity, completed 1-29-55, TD 7139.

ARKANSAS—OIL FIELD EXTENSION

Union County, Sandy Bend field. Parks & Meabon's J. A. Simmons 1, C NW NE SW 12-18s-13w, ⅜-mile northwest extension, pumped 6 barrels oil and 4 barrels water from Nacatoch sand, Upper Cretaceous 2293-2404 feet, 25-gravity, completed 1-10-55, TD 2404.

CALIFORNIA—NEW OIL PAYS

Kern County, McDonald Anticline field. Ferguson & Bosworth's Honolulu Layman 4, in 18-28s-20e, pumped 120 barrels oil and 4 barrels water from Point of Rocks sand, Pliocene 3449-3552 feet, 42-gravity, completed 1-7-55, TD 3552.

Tejon field. Reserve Oil & Gas Co.'s E. W. Pauley-Reserve 41A-34, in 34-11n-19w, flowed 138 barrels from Transition sand, Pliocene 2735-2805 feet, 17/64-inch, 19.3-gravity, completed 12-29-54, TD 2805.

CALIFORNIA—NEW DISTILLATE PAY

Fresno County, Coalinga, West field. W. W. Holmes & Associate's Well 1, in 25-19s-14e, Old Well Drilled Deeper, flowed ungaged distillate and 1.0 million from Joaquin Ridge sand, 5122-5290 feet, ¼-inch, completed 12-20-54, TD 5300.

CALIFORNIA—NEW GAS PAY

Yolo County, Winters, North field. Bandini Petroleum Corp.'s Griffin 1, in 1-8n-1w, flowed 5.0 million from McCune sand, Miocene 4712-25 and 4729-33 feet, ¼-inch, completed 1-5-55, TD 4900.

CALIFORNIA—OIL FIELD EXTENSION

Orange County, Huntington Beach field. Jack B. Crawford et al's Huntington 5, in 14-6s-11w, pumped 754 barrels from Jones sand, 3740-3905 feet, 32/64-inch, 21.8-gravity, completed 1-1-55, TD 3905.

COLORADO—NEW OIL FIELDS

Elbert County. Sinclair Oil and Gas Co.'s Tom O. Bradbury 1, NE NE NE 28-6n-61w, pumped 15 barrels oil and 13 barrels water from Dakota "J" sand, Upper Cretaceous, 7175-82 feet, completed 1-4-55, TD 7333.

Logan County. Creslenn Oil Co.'s Ramey 1, SE SE 17-10n-53w, pumped 68 barrels oil and 15 barrels water from Dakota "D" sand, Upper Cretaceous 4808-75 feet, completed 1-15-55, TD 5134.

Morgan County. John L. Nelson's Fornick 1, C NW SW 1-6n-59w, pumped 150 barrels from Dakota "D" sand, Upper Cretaceous 6475-81 feet, completed 1-21-55, TD 6735.

Washington County, Akron, East field. Wytex Service Corp. & Jack Ladmer's Daniels 1, C SE SW 25-3n-52w, pumped 80 barrels from Dakota "D" sand, Upper Cretaceous, 4540-54 feet, completed 1-9-55, TD 4638.

"Camp Creek" field. Eddie Fisher's Gebauer 1, SE SE SE 4-1n-53w, pumped 75 barrels from Dakota "J" sand, Upper Cretaceous, 4852-55 feet, completed 1-15-55, TD 4940.

Unnamed field. Kimbark Co. Ltd. & Sterling Drilling Co.'s Porter 1, C SW SW 30-2s-55w, pumped 85 barrels from Dakota "J" sand, Upper Cretaceous, 4984-87 feet, completed 12-9-54, TD 5150.

COLORADO—NEW GAS FIELDS

Logan County, Coyote field. Shell Oil Co.'s State 694-A-1, C NW SE, 12-6n-53w, flowed 2.3 million from Dakota "D" sand, Upper Cretaceous 4525-30 feet, 48/64-inch, completed 1-2-55, TD 4690.

Unnamed field. Shell's State Lease 694-B-1, NW NE 1-6n-53w, flowed 3.3 million from Dakota "D" sand, Upper Cretaceous 4418-24 feet, ¾-inch, completed 1-11-55, TD 4572.

Mesa County. Great Basins Petroleum Co.'s Unit 1, SE SW SW 29-8s-100w, flowed 3.0 million from Mesaverde sand, Upper Cretaceous, 763-951 feet, ¼-inch, completed 1-14-55, TD 2132.

COLORADO—NEW OIL PAY

Washington County, Little Beaver field. Continental Oil Co.'s G. C. Adkins 1, NE SW SW 26-1s-56w, pumped 54 barrels oil and 97 barrels water from Dakota "J" sand, Upper Cretaceous, 5150-55 feet, 40-gravity, completed 1-26-55, TD 5200.

COLORADO—NEW GAS PAY

Logan County, Atwood, East field. A. A. Seeligson, Sam Gary & Strain Drilling Co.'s Kapernik 1, C SW NE 25-7n-53w, ungaged from Dakota "D" sand, Upper Cretaceous, completed 11-13-54, TD 4542.

COLORADO—OIL FIELD EXTENSIONS

Adams County, Knox field. Superior Oil Co.'s Moore 61-2, NE NW NE, 2-2s-59w, 1-mile south extension, pumped 139 barrels from Dakota "D" sand, Upper Cretaceous, 6157-63 feet, 38-gravity, completed 1-21-55, TD 6328.

Rosener field. S. D. Johnson et al's Rosener-Bain 1, SE SE NE, 11-1s-59w, flowed 47 barrels from Dakota "J" sand, Upper Cretaceous, 6245-48 feet, 46.2-gravity, completed 1-15-55, TD 6315.

Logan County, Divide field. Skelly Oil Co.'s C. F. Schaer 3, SW NW SW, 2-8n-53w, flowed 240 barrels from Dakota "D" sand, Upper Cretaceous, 4775-81 feet, 40/64-inch, completed 1-4-55, TD 4781.

ILLINOIS—NEW OIL FIELDS

Edwards County, Samsville, Northwest field. Skiles Oil Co.'s Bunting 1-A, SW SW SE, 24-1n-10e, pumped 98 barrels from Lower O'Hara lime, Mississippian 3190-94 feet, completed 1-18-55, TD 3248.

Marion County, Exchange, East field. Union Contracting & Engineering Co.'s E. F. Hawkins 1, SE SW SW 29-1n-4e, pumped 100 barrels from McClosky lime, Mississippian, 2908-12 feet, completed 1-11-55, TD 2919.

ILLINOIS—NEW OIL PAYS

Gallatin County, Roland Consolidated field. W. C. McBride, Inc.'s S. Moore 2, NE NE NE 24-7s-8e, pumped 36 barrels from Golconda lime, Mississippian, 2506-11 feet, completed 1-18-55, TD 2967.

Shawneetown, East field. Vandenbark-McGuire's Hall-Clayton 1, NE SE NW, 22-9s-10e, pumped 23 barrels oil and 48 barrels water from Bethel sand, Mississippian, 2481-2525 feet, completed 1-11-55, TD 2727.

ILLINOIS—OIL FIELD EXTENSIONS

Christian County, Mt. Auburn Consolidated field. E. Gallagher's C. R. Osbern 1-A SW NE 10-15n-1w, ¾-mile east extension, pumped 30 barrels oil and 17 barrels water from Silurian lime, Silurian, 1860-82 feet completed 1-25-55, TD 1882.

Clay County, Sailor Springs Consolidated field. Shulman Bros.' Duff 1, NW NW NW 7-3n-8e, ½-mile extension, pumped 15 barrels oil and 450 barrels water Rosiclare sand, Mississippian, 2998-3000 feet, completed 1-25-55, TD 3002.

Effingham County, Hill, East field. Partlow & Cochonour's A. M. Woody 1, NW NW SW 12-6n-6e, 1-mile east extension, pumped 25 barrels oil and 40 barrels water from Cypress sand, Mississippian 2459-80 feet, completed 1-25-55, TD 2825.

Moultrie County, Gays field. Pure Oil Co.'s Waggoner Consolidated 1, SE NW SW 22-12n-6e, ¾-mile east extension, pumped 48 barrels oil and 58 barrels water from Aux Vases sand, Mississippian 1962-90 feet, completed 1-11-55, TD 3305.

Saline County, Eldorado, North field. R. W. Portis' Lassater 1, SW SW NE 15-8s-7e, ¾-mile extension, flowed 720 barrels from Waltersburg sand, Mississippian 2118-60 feet, completed 1-18-55, TD 2637.

Wayne County, Ellery Consolidated field. Calvert Drilling, Inc.'s M. D. Carter 1, SE SW NW 22-2s-9e, ½-mile extension, flowed 289 barrels from Aux Vases sand, Mississippian 3202-38 feet, completed 1-18-55, TD 3370.

INDIANA—NEW OIL FIELDS

Daviess County. Cecil Smith's Arlan Nolley 1, C W½ SE NE 13-2n-6w, pumped 20 barrels from Benoist sand, Mississippian 767-75 feet, TD 919.

Spencer County. Robert Harboe's John Huebschman 1, NW NW SE 14-5s-4w, pumped 6 barrels from McClosky sand, Mississippian 714-18 feet, TD 718.

Unnamed field. Slagter Producing Co.'s Clyde Jones 1, SE NE SW 34-7s-7w, pumped 7 barrels from Jackson sand, Mississippian 1323-35 feet, TD 1335.

KANSAS—NEW OIL FIELDS

Barton County, Herres field. Skelly Oil Co.'s Herres 1, SW NW SE 33-17s-13w,

COOPER "420"

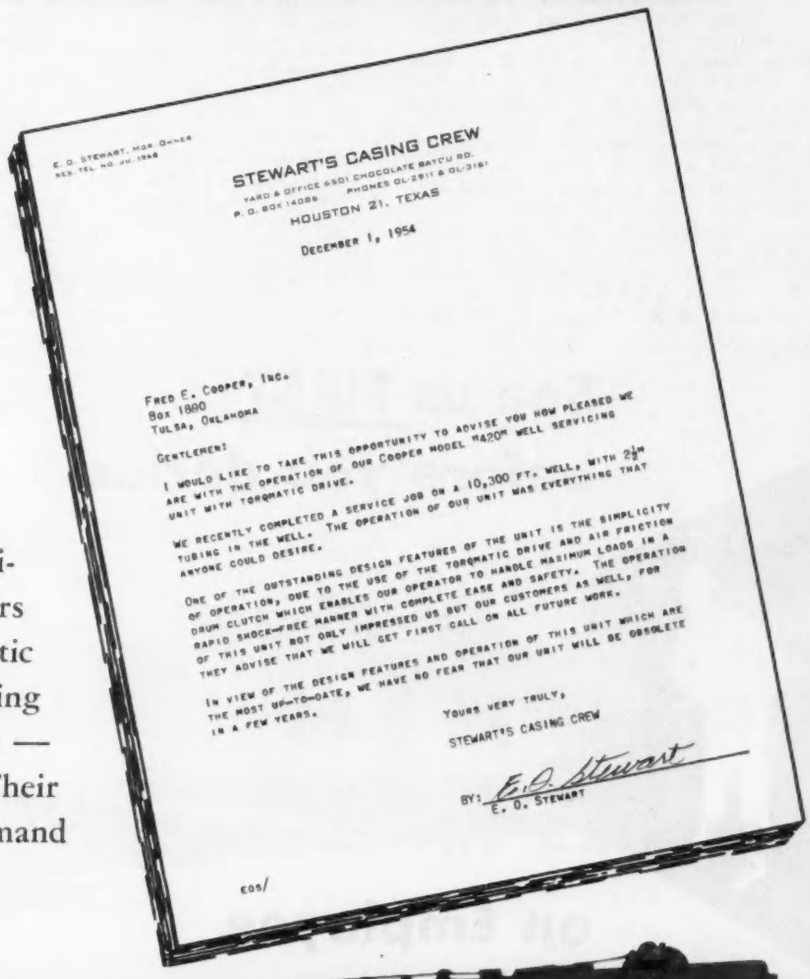
SERVICING and WORKOVER RIGS

WHAT DO THE OPERATORS SAY?

Read what Mr. E. O. Stewart thinks of the COOPER "420".

Stewart's casing crew, a highly successful contracting organization operating in the Houston area, has been in the business many years. They know their business and they know machinery.

This is only one of many complimentary reports received from owners and operators of Cooper Torqmatic Units. Every one of them stressing *Easy, simple shock-free operation — Speed, safety and modern design.* Their customers request and sometimes demand Cooper Torqmatic Drive Rigs.



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By: E. O. Stewart
E. O. Stewart

eos/

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Owners of modern, Torqmatic Drive Rigs get "first call" for those deep wells that require the best of equipment.

FRED E. Cooper, Inc.

P. O. BOX 1890 TULSA, OKLA.

pumped 162 barrels from Arbuckle lime, Ordovician 3344-54 feet, TD 3354.

Unnamed field. Schermerhorn & Thunderbird's Hart 1, NE NE NW 9-20s-13w, pumped 190 barrels from Lansing lime, Pennsylvanian 3317-25 feet, TD 3542.

Unnamed field. Skelly's Woodmansee 1, SE NE SE 21-18s-13w, pumped 15 barrels from Arbuckle lime, Ordovician 3303-11 feet, TD 3311.

Cowley County. Veeder Supply Co.'s Lane 1, NW SW SE 9-33s-6e, pumped 10 barrels from Mississippi lime, Mississippian 3075-80 feet, TD 3530.

Hamilton County. United Production Co.'s Helfrich 1, C SE SE 6-25s-42w, pumped 50 barrels from Morrow sand, Mississippian 5040-50 feet, TD 5640.

Harper County. Carter Oil Co.'s Levand 1, C SW SE 35-31s-9w, pumped 17 barrels from Mississippi lime, Mississippian 4393-98 feet, TD 4400.

Unnamed field. Musgrove Petroleum Co.'s Durgess 1, NW NW SW 21-31s-8w, pumped 185 barrels oil and 20 barrels water from Mississippi lime, Mississippian 4382-87 feet, TD 4419.

Kiowa County, Pyle field. Falcon-Seaboard & Gulf Oil Corp.'s Pyle 1, NE NE NE 16-29s-16w, pumped 304 barrels from Mississippi lime, Mississippian 4666-80 feet, TD 4720.

Marion County, French Creek field. Anderson-Prichard Oil Corp.'s Jost 1, SW NW SW 22-19s-2e, pumped 27 barrels oil and 4 barrels water from Simpson sand, Ordovician 3020-25 feet, TD 3082.

McPherson County, Lindsborg, South field. Rupp-Ferguson's Lundstrom 1, SW SW NW 6-18s-3w, pumped 25 barrels from Simpson sand, Ordovician 3525-27 feet, TD 3527.

Rush County, Rush Center, Northeast field. Imperial Drilling Co.'s Krug 1, SW SW NE 10-18s-18w, pumped 1039 barrels from Arbuckle lime, Ordovician 3807-27 feet, TD 3853.

Stafford County. N.C.R.A.'s Curtis 1, NE NE NE 18-25s-13w, Old Well Worked Over, pumped 135 barrels from Lansing lime, Pennsylvania 3946-49 feet, TD 4330.

KANSAS—NEW GAS FIELDS

Barber County. G-M-R Oil and Lion Oil Co.'s Moffett 1, NE NE SE 9-30s-15w, flowed 10.0 million from Pennsylvania sand, Pennsylvanian 4571-4676 feet, open, TD 4838.

Kingman County. Cities Service Oil Co.'s Voran 1, SE SW NE 27-29s-7w, flowed 1.0 million from Mississippi lime, Mississippian 4117-38 feet, open, TD 4665.

Pratt County, Carver-Robbins field. M. B. Armer & N.C.R.A.'s Robbins 1, NE NE NE 21-27s-15w, flowed 8.5 million from Conglomerate, Pennsylvanian 4478-82 feet, open, TD 4815.

Unnamed field. Lario Oil & Gas Co.'s Chastain 1, NW SW NW 24-29s-1e, flowed 2.5 million from Lansing lime, Pennsylvanian 4141-48 feet, open, TD 4669.

Rush County. Morrison Drilling Co.'s Rathe 1, SE NE NW 31-17s-16w, flowed 4.0 million from Lansing lime, Pennsylvanian 3446-52 feet, open, TD 3564.

KENTUCKY—NEW OIL FIELDS

Henderson County. Spencer Chemical Co.'s Fee 1, NE NE SE 7-P-23, pumped 8 barrels from Cypress sand, Mississippian 2128-41 feet, TD 2627.

McLean County. C. W. Lee's J. E. Chissom 1, in 7-M-30, pumped 97 barrels from Palestine sand, Mississippian 1235-49 feet, TD 1249.

NORTH LOUISIANA—NEW OIL PAY

Tensas Parish, Locust Ridge field. Southern Natural Gas Co.'s Philip Watson 1, in 28-10n-11e, flowed 165 barrels from Massive-Tuscaloosa sand, Upper Cretaceous 9109-10 feet, ⅛-inch, 39.3-gravity, completed 1-22-55, TD 9118.

NORTH LOUISIANA—NEW GAS PAY

Ouachita Parish, Bridge Brake field. Carter Oil Co.'s Rhymes-McGuire 1, C NE SW 23-17n-4e, flowed estimated 5.0 million from Upper Pettit sand, Lower Cretaceous 5079-84 feet, ⅜-inch, completed 1-5-55, TD 6305.

NORTH LOUISIANA—OIL FIELD EXTENSIONS

Bossier Parish, Cottage Grove field. George Belchic, Jr.'s E. Johnson 1, in 13-21n-14w, 1¼-mile northwest extension, flowed 95 barrels from Buckrange sand, Upper Cretaceous 1939-47 feet, ¼-inch, 25.2-gravity, completed 1-17-55, TD 2300.

Catahoula Parish, Larto Lake field. E. C. Wentworth's Beltzhoover et al 1, C SW NW 8-5n-6e, 1⅛-mile northeast extension, pumped 98 barrels from Wilcox sand, Eocene 5716-19 feet, completed 1-2-55, TD 6236.

NORTH LOUISIANA—DISTILLATE FIELD EXTENSIONS

Caddo Parish, Greenwood-Waskom field. Stanolind Oil & Gas Co.'s W. J. Hunter 1, C NE SW 28-17n-16w, 3¼-mile southwest extension, Old Well Drilled Deeper, flowed ungaged distillate and 8.2 million from Cotton Valley "D" sand, Jurassic 8515-70 feet, open, completed 1-2-55, TD 8962.

Claiborne Parish, Athens field. J. C. Trahan's Julius Canty 1, in 20-20n-6w, ½-mile east extension, flowed 72 barrels distillate and 4.3 million from Pettit lime, Lower Cretaceous 6076-84 feet, open, and 34 barrels distillate and 1.4

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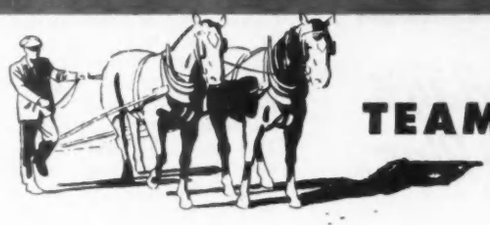
"It is as impossible to give the greater credit for petroleum's magnificent progress to either the oil operators or the fabricators of their equipment, as it is to say whether the hen or the egg came first."

Quoted from a speech by the president of a major oil company



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The reason it is hard to say which deserves the greater credit is that the operators and their suppliers team up so well together. That's why the progress of the oil industry has been so astounding.

Our petroleum manufacture-supply-service industry (P.E.S.A.) is well equipped to do its part. The value of its combined physical plants runs into billions of dollars. It is well equipped with an ample supply of brains, too—over 9,000 research scientists, development engineers, metallurgists, design engineers, service engineers. It plows back more than half its earnings into new facilities to further the progress of the great petroleum industry.

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* Petroleum Equipment Suppliers Association

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million from Travis Peak sand, Lower Cretaceous 6421-32 feet, open, completed 1-14-55, TD 7100.

SOUTH LOUISIANA—NEW OIL FIELDS

Iberia Parish. Continental Oil Co.'s Jeanerette Lumber & Shingle Co. C-1, in 11-12s-10e, flowed 159 barrels from 7447-53 feet, 8/64-inch, 35.9-gravity, completed 1-30-55, TD 13,001.

Plaquemines Parish, South Pass area. Shell Oil Co.'s State Lease 1, Block 6, Gulf of Mexico, flowed 288 barrels from 8337-49 feet, 10/64-inch, 33-gravity, completed 1-17-55, TD 11,010.

SOUTH LOUISIANA—NEW OIL PAYS

Ascension Parish, Darrow field. Temple Hargrove et al's Gulf-Fee-Belle Helene A-2, in 27-10s-2e, Old Well Worked Over, flowed 142 barrels from 6430-42 feet, 8/64-inch, 33.8-gravity, completed 1-10-55, TD 6570.

Beauregard Parish, East Tulla field. Sunray Oil Corp.'s Longbell Lumber Co. 2, in 10-4s-8w, Old Well Worked Over, flowed 72 barrels oil and 48 barrels water from 12,006-238 feet, 16/64-inch, 39.2-gravity, completed 1-12-55, TD 12,884.

Jefferson Parish, Grand Isle-Block 16. Humble's State Lease G-3, Block 23, Gulf of Mexico, flowed 145 barrels from 6710-20 feet, ⅛-inch, 42.3-gravity, completed 1-14-55, TD 6928.

LaFourche Parish, Larose field. Humble's P. G. Lake 1, in 35-17s-21e, flowed 535 barrels from 11,378-88 feet, 3/16-inch, 37.1-gravity, and 129 barrels distillate and 3.8 million from 11,994-12,012 feet, 3/16-inch, 47.3-gravity, completed 1-9-55, TD 12,100.

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Plaquemines Parish, West Delta-Block 30. The California's Co.'s State Lease 1069-A-1, Gulf of Mexico, flowed 232 barrels from 8186-8222 feet, 9/64-inch, 40.2-gravity, completed 1-19-55, TD 9571.

West Delta-Block 30. Humble's State Lease 820-E-3, Block 31, Gulf of Mexico, flowed 228 barrels from 8733-50 feet, ⅛-inch, 32.3-gravity, completed 1-11-55, TD 10,449.

St. Martin Parish, Section 28 field. Kerr-McGee Oil Ind., Inc.'s St. Martin Land Co. 3, in 22-9s-7e, flowed 398 barrels from 11,230-240 feet 12/64-inch, 35.8-gravity, completed 1-8-55, TD 12,352.

Terrebonne Parish, South Pelto field. Magnolia Petroleum Co.'s State Lease 793-A-2, Block 19, Gulf of Mexico, flowed 818 barrels from 10,274-80 and 10,284-96 feet, 10/64-inch, 35-gravity, completed 1-23-55, TD 12,770.

SOUTH LOUISIANA—NEW DISTILLATE PAYS

Calcasieu Parish, Phoenix Lake field. Ohio Oil Co.'s E. W. Brown, Jr. 38, in 20-11s-13w, flowed 502 barrels distillate, 2.8 million and 82 barrels water from 10,-222-237 feet, 12/64-inch, 47.6-gravity, compleetd 1-24-55, TD 12,491.

Cameron Parish, East Cameron-Block 71. Continental's State Lease 1625-A-2, Gulf of Mexico, flowed 10 barrels distillate and 1.9 million from 7996-8006 feet, 10/64-inch, 47-gravity, completed 1-15-55, TD 9450.

West Cameron-Block 192. Continental's State Lease 1654-A-4, Gulf of Mexico, flowed 6 barrels distillate and 2.5 million from 5987-92 feet, completed 1-28-55, TD 13,112.

St. Mary Parish, Franklin field. The California Co.'s Fairfax Foster Bailey et al 2-1, in 68-14s-9e, flowed 46 barrels distillate and 4.8 million from 12,330-38 feet, 16/64-inch, 41.7-gravity, completed 1-12-55, TD 13,630.

Terrebonne Parish, Orange Grove field. Ted Weiner's O. H. Wylie 6, in 84-17s-16e, flowed ungaged distillate and 4.6 million from Upper Miocene sand, 10,-560-565 feet, 12/64-inch, completed 1-10-55, TD 10,612.

SOUTH LOUISIANA—OIL FIELD EXTENSIONS

Assumption Parish, East Lake Palourde field. Humble's Norman-Breaux Lumber Co., Inc. 1, in 25-15s-13e, 1-mile west extension, flowed 240 barrels from 12,702-706 feet, ⅛-inch, 35.2-gravity, completed 1-2-55, TD 13,500.

Napoleonville field. Texas Gulf Prod. & Pan American Production Co.'s Dugas-LeBlanc A-3, in 28-12s-14e, 1¾-mile southwest extension, flowed 192 barrels from 9436-42 feet, 13/64-inch, 33.2-gravity, completed 1-25-55, TD 9694.

Beauregard Parish, Clear Creek field. H. L. Hunt's C. Doornbos 3, in 11-6s-8w, ½-mile west extension, flowed 150 barrels from Cockfield sand, Eocene 8868-72 feet, 8/64-inch, 49-gravity, completed 1-18-55, TD 9146.

Iberville Parish, Laurel Ridge field. Humble's N. G. Huth 1, in 9-10s-13e, ¾-mile north extension, flowed 215 barrels from 10,105-114 feet, ⅛-inch, 37.2-gravity, completed 1-25-55, TD 10,680.

SOUTH LOUISIANA—DISTILLATE FIELD EXTENSION

Iberia Parish, Fausse Pointe field. Cities Production Co.'s Granger 1, in 33-11s-8e, 1-mile southwest extension, flowed 64 barrels distillate and 6.0 million from 9603-20 feet, 20/64-inch, 46-gravity, completed 1-13-55, TD 10,700.

SOUTH LOUISIANA—GAS FIELD EXTENSIONS

LaFourche Parish, Golden Meadow field. Natural Gas & Oil Corp.'s Tamplain-Talbot A-1, in 19-19s-22e, ½-mile east extension, ungaged from Upper Miocene sand, 2604-16 feet, completed 1-27-55, TD 4450.

St. Landry Parish, Washington field. Sohio Petroleum-Gulf Refining Co.'s Thistlethwaite Lumber Co. Ltd. 17, in 6-5s-5e, 1-mile southeast extension, ungaged from Claiborne sand, Eocene 9575-9600 feet, completed 1-5-55, TD 9675.

MICHIGAN—NEW OIL FIELD

Allegan County. Monarch Oil Co.'s McIntosh & Culber 1, S½ NE SE 10-2n-13w, Allegan township, pumped 2 barrels from Traverse lime, Devonian 1470-74 feet, TD 1474.

MISSISSIPPI—NEW OIL PAYS

Adams County, Mandamus field. John S. Callon & D. A. Biglane's Armstrong I-1, in 22-5n-2w, flowed 127 barrels oil and 55 barrels water from Wilcox sand, Eocene 5686-89 feet, 10/64-inch, 41-gravity, completed 1-23-55, TD 6754.

North Overton field. Hellenic Oil & Gas Co. & Southern Production Co.'s Egypt C-3, in 8-5n-2w, pumped 94 barrels oil and 140 barrels water from Wilcox-Parker sand, Eocene 6454-56 feet, completed 1-28-55, TD 6650.

MONTANA—NEW OIL FIELD

Fallon County. Mon-O-Co Oil Corp.'s Ferguson-Goldin 1, C SE SW 18-7n-61e, flowed 132 barrels from Red River lime, Ordovician 9246-84 feet, 20/64-inch, completed 11-8-54, TD 9286.

MONTANA—OIL FIELD EXTENSION

Wibaux County, Pine field. Stanolind Oil & Gas Co.'s State 1, C NE NE 16-11n-57e, 1-mile southeast extension, flowed 413 barrels from Silurian lime, 8360-8450 feet, Stony Mountain lime, Ordovician 8754-8818 feet and Red River lime, Ordovician 8888-9038 feet, 24/64-inch, completed 1-12-55, TD 9038.

NEBRASKA—NEW OIL FIELDS

Banner County. Empire Drilling Co.'s Stauffer 1, SW SE SW 15-18n-55w, pumped 364 barrels from Dakota "D" sand, Upper Cretaceous 6048-58 feet, open, 38-gravity, completed 1-8-55, TD 6191.

Cheyenne County. Ryan Oil Co.'s Graham 1, SW SW SW 20-16n-51w, pumped 168 barrels from Dakota "J" sand, Upper Cretaceous 5216-22 feet, completed 1-16-55, TD 5275.

Kimball County. Skelly Oil Co.'s Harry Phillips 1, SE SE NW 8-12n-54w, pumped 155 barrels oil and 28 barrels water from Dakota "J" sand, Upper Cretaceous 6111-20 feet, completed 1-15-55, TD 6209.

Unnamed field. Tom Palmer, Inc.'s State 1-C, SE SE NW 36-13n-55w, pumped 95 barrels from Dakota "D" sand, Upper Cretaceous 6157-62 feet, completed 1-21-55, TD 6289.

NEW MEXICO—NEW OIL FIELDS

Chaves County. Ross Sears' Gale-State 1, in 22-13s-31e, pumped 114 barrels from Queen sand, Pennsylvanian 3020-44 feet, 38-gravity, completed 12-22-54, TD 3044.

Sandoval County. Fred Turner, Jr.'s Jicarilla 1, SW NE NE 32-23n-4w, pumped 28 barrels from Point Lookout sand, Upper Cretaceous 4380-90 feet, open, 38-gravity, completed 1-21-55, TD 4417.

NEW MEXICO—NEW DISTILLATE FIELD

Lea County. Continental's West Anderson Ranch 1, in 6-16s-32e, flowed 443 barrels distillate and 5.0 million from Lower Pennsylvanian sand, 12,512-550 feet, open, 55.6-gravity, completed 12-31-54, TD 14,015.

NEW MEXICO—NEW GAS FIELD

Lea County. Anderson-Prichard Oil Corp.'s American-Republics Federal 1, in 28-25s-37e, flowed 67.5 million from Devonian lime, Devonian 8270-8390 feet, open, completed 1-18-55, TD 10,830.

NEW MEXICO—NEW OIL PAYS

Lea County, Bronco field. Amerada Petroleum Corp.'s L. W. Ward 4, in 11-13s-38e, flowed 537 barrels from Pennsylvanian lime, 9607-28 feet, 20/64-inch, 43.8-gravity, completed 12-10-54, TD 9645.

Caprock, East field. Great Western Drilling Co.'s Magnolia-Speed 1, in 15-21s-32e, flowed 99 barrels from Queen sand, Permian 3005-17 feet, 24/64-inch, 36.4-gravity, completed 1-24-55, TD 3017.

NEW MEXICO—OIL FIELD EXTENSIONS

Chaves County, Drickey field. Roland Rich Woolley's Woolley-Queen 2, in 35-13s-31e, 1-mile north extension, flowed 998 barrels from Queen sand, Permian 3041-59 feet, open, 38-gravity, completed 12-24-54, TD 3059.

Lea County, D-K field. Murphy H. Baxter's State 1, in 36-20s-38e, 1-mile south extension, pumped 75 barrels from Abo lime, Permian 7310-7460 feet, 37.8-gravity, completed 1-7-55, TD 7460.

NEW MEXICO—GAS FIELD EXTENSIONS

San Juan County, Blanco field. J. Glenn Turner's Ballard 3-12, NW SE NE 12-26n-9w, 1-mile east extension, flowed 1.2 million from Pictured Cliffs sand, Upper Cretaceous 1903-72 feet, completed 1-11-55, TD 1972.

Blanco field. Southern Union Gas Co.'s Newsom 2, NE SW SW 17-26n-8w, 2-mile east extension, flowed 4.7 million from Pictured Cliffs sand, Upper Cretaceous 2011-91 feet, open, completed 12-11-54, TD 2091.

Rio Arriba, Blanco field. Stanolind's Jicarilla 4, NE SW SE 32-26n-5w, 1-mile southeast extension, flowed 10.0 million from Pictured Cliffs sand, Upper Cretaceous 2779-2829 feet, completed 1-15-55, TD 2829.

NORTH DAKOTA—OIL FIELD EXTENSIONS

Burke County, Tioga field. Carter Oil Co.'s Katie Torgerson 1, C SW SE 29-159n-94-w, ½-mile northeast extension, flowed 240 barrels from Madison lime, Mississippian 8015-28 feet, ¼-inch, 39.8-gravity, completed 1-15-55, TD 8100.

Williams County, McGregor field. Western Nodana & Paul F. Rutledge's Frank E. McCoy 1, C NW NW 30-159n-95w, 1-mile north extension, flowed 122 barrels oil and 14 barrels water from Madison lime, Mississippian 8146-53 feet, 12/64-inch, 42-gravity, completed 1-6-55, TD 8153.

OHIO—NEW GAS FIELD

Noble County, Caldwell field. Great Lakes Carbon Co.'s Homer Guiler 1, Section 25, Center Township, flowed 0.2 million from Clinton sand, Silurian 5719-41 feet, completed 1-10-55, TD 5887.

OHIO—GAS FIELD EXTENSION

Knox County, Mt. Vernon field. Frank

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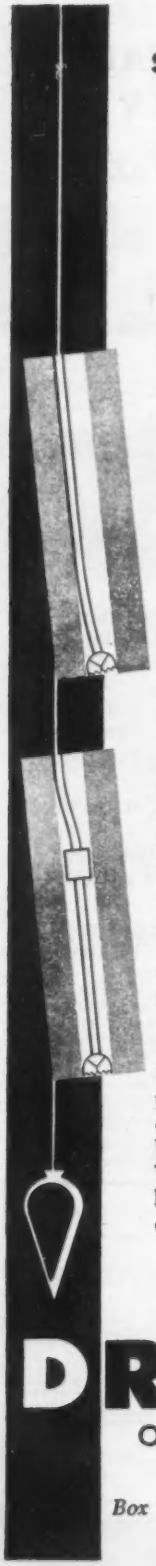

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Lyons et al's Wilford Colopy 1, Section 15, Union Township, flowed 1.3 million from Clinton sand, Silurian 2878-2902 feet, completed 1-3-55, TD 2964.

OKLAHOMA—NEW OIL FIELDS

Cleveland County, Falls, Northseat field. Herman Brown's Perkins & Todd 1, SE SW NW 21-9n-1w, flowed 180 barrels from 2nd Wilcox sand, Ordovician 7148-58 feet, 10/64-inch, 35-gravity, TD 7824.

Garvin County, Maysville, East field, Stanolind's Pitchlynn 1, SE SW SE 14-4n-2w, flowed 966 barrels from Bromide sand, Ordovician 5936-78 feet, ¾-inch, 40-gravity, TD 7100.

Logan County. Lang & Unger's L. Bohanon 1, SE NE NW 34-15n-3w, flowed 16 barrels from Simpson dolomite, Ordovician 6174-84 feet, ¾-inch, TD 6370.

Marshall County, Madill, North field. Sinclair Oil & Gas Co.'s B. L. Griffin 1, SE NE NE 16-5s-5e, flowed 24 barrels from McLish sand, Ordovician 6587-6635 feet, 14/64-inch, 37.3-gravity, TD 7636.

Noble County. LaGorce Oil Co.'s Mary Hess 1, NW SW NE 33-22n-1w, flowed 25 barrels oil and 150 barrels water from Sams sand, Permian 1620-26 feet, 20/64-inch, TD 2130.

Oklahoma County. N. T. Smith's Vorel 1, SW SW SE 14-14n-1e, flowed 60 barrels from Skinner sand, Pennsylvanian 4912-17 feet, 14/64-inch, 39-gravity, TD 5218.

Payne County. Royal Oil & Gas Corp.'s Brattain 1, SW SE NE 26-19n-3e, flowed 470 barrels from Wilcox sand, Ordovician 4347-53 feet, ½-inch, TD 4383.

OLKAHOMA—NEW DISTILLATE FIELDS

Logan County. J. M. Shields' State 1-A, NE NE SE 36-16n-1e, flowed 239 barrels distillate and 21.7 million from Miseener sand, Mississippian 4940-49 feet, 1-inch, 71-gravity, TD 5366.

Texas County, Grand Valley, Northwest field. Carter Oil's Harold Gibson 1, C SE NE 21-2n-19ecm, flowed 73 barrels distillate and 12.0 million from Morrow sand, Pennsylvanian 6464-71 feet, TD 6912.

OKLAHOMA—NEW OIL PAYS

Beaver County, Mocane field. United Producing Co.'s E. E. Evans 2, C SW NE 18-5n-25ecm, flowed 88 barrels from Morrow sand, Pennsylvanian 6412-52 feet, 44-gravity, TD 6923.

Grady County, Bradley, North field. Phillips' Worden 1, C SW NE 23-5n-5w, flowed 164 barrels from Tulip Creek sand, Ordovician 12,108-127 feet, 9/64-inch, TD 13,040.

OKLAHOMA—NEW GAS PAY

Texas County, Guymon-Hugoton field. Kansas-Nebraska Natural Gas Corp.'s L. Brown 1, NW NW SE 25-2n-18ecm, flowed 8.8 million from Morrow sand, Pennsylvanian 6442-6521 feet, TD 6902.

OKLAHOMA—OIL FIELD EXTENSIONS

Carter County, Brock, East field. Seaboard Oil Co.'s W. A. Kistler 1, NE SE NW 15-5s-1e, ⅔-mile northwest extension, flowed 180 barrels from Tulip Creek sand, Ordovician 3966-92 feet, ⅜-inch, 43-gravity, TD 4342.

Garvin County, Golden Trend field. Sinclair's Arthur W. Jones 1, C NW SE 29-4n-4w, flowed 156 barrels from Hart sand, Pennsylvanian 8800-8950 feet, ¾-inch, 38-gravity, TD 10,559.

Lincoln County, Olivet field. The Texas Co.'s W. A. Stumbo 1, SW SW NW 22-17n-2e, ½-mile east extension, pumped

Arrangements have been made through the undersigned for the sale of these securities privately for investment. They have not been and are not being offered for sale to the public. This announcement appears as a matter of record only.

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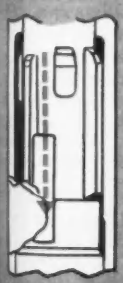


TO RELEASE, tool is tripped, moving drive keys downward.

1 RUN THE TOOL IN THE DRILL STRING—it's specifically designed to withstand the continuous torque and vibration of modern drilling operations. The tool has been used successfully throughout the world—and at world-record depths. At all depths it provides the extra safety of double drill string protection!

2 TO USE FOR JARRING, simply slack off weight of approximately 2,000 feet of drill pipe onto the tool. This weight releases the tripping mechanism and strikes a sharp downward blow. Raising the string automatically re-sets the tool for another blow—and repeated blows can be struck as fast as the string can be raised and lowered. *It's as simple and positive as that!*

3 TO RELEASE, in the event jarring will not loosen the stuck string, simply trip the tool and apply reverse torque as the string is slowly raised. One-sixth turn of the drive keys rotates them into an unlocking slot so that complete release is obtained by continuing to raise the string.

LEFT TORQUE rotates drive keys into unlocking slot as string is raised.

4 THE TOOL TRANSMITS TORQUE LOADS in *either* direction through drive keys—*not* through threads—a *big* advantage over conventional safety joints. In fact, until the definite releasing operations are performed in proper sequence, the tool remains the strongest joint in the drill string. Yet by first tripping the tool, it can be quickly released.

5 THE TOOL CAN BE RE-CONNECTED in the hole by simply using the recovered portion at the bottom of a fishing string for mating with the portion left on top of the fish. It's simple, quick!

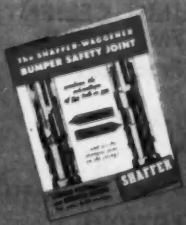
Added Proof

These typical job records further show the all-around utility of the Shaffer-Waggener Bumper Safety Joint . . .

3½ MILES DEEP: On this job, the Bumper Safety Joint was released from stuck drill collars at 18,136 ft. (almost 3½ *miles* deep) requiring only 2¾ turns of reverse torque *at the table*. Recovered portion of tool was then attached to bottom of fishing string, run back into hole and connected to fish. After jarring, bit and drill collars were freed, leaving hole completely clean!

3 MILES DEEP: On another job at 16,883 ft. (over 3 *miles* deep) a Bumper Safety Joint being run in the drill string greatly simplified recovery of a parted and dropped string, again leaving hole completely clean!

SLANT HOLES—a problem with conventional safety tools—are no obstacle to the Shaffer-Waggener Bumper Safety Joint. Even directionally-drilled wells with extreme slant are handled in stride.



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32 years OF OIL TOOL

42 barrels oil and 102 barrels water from Layton sand, Pennsylvanian 3288-98 feet, 39-gravity, TD 4165.

OKLAHOMA—DISTILLATE FIELD EXTENSION

Garvin County, Bradley field. Cities Service's McCoy 1, C NE NE 17-4n-4w, southeast extension, flowed 245 barrels distillate and 1.9 million from Hart sand, Pennsylvanian 8148-8262 feet, 18/64-inch, 60.5-gravity, TD 8900.

OKLAHOMA—GAS FIELD EXTENSION

Lincoln County, Midlothian, Northwest field. Davon Oil & Gas Co.'s Hoffman 1, SE NW NW 36-14n-3e, flowed 5.5 million from Skinner sand, Pennsylvanian 4140-52 feet, ¾-inch, TD 4330.

TEXAS DISTRICT 1—NEW OIL FIELDS

Atascosa County, "Bob Hindes, East" field. Plymouth Oil Co.'s Bob Hindes et ux 6, between Wm. Dunbar & A. Houston Surveys, pumped 42 barrels oil and 8 barrels water from Carrizo sand, Eocene 2144-47 feet, 18.6-gravity, completed 12-14-54, TD 2147.

"Crews" field. Tom Crews' S. P. Finch 2, Galba Fuqua Survey, pumped 70 barrels from Carrizo sand, Eocene 1578-82 feet, 18.8-gravity, completed 1-12-55, TD 1582.

Travis County, Kimbro area. Houston-Oklahoma Oil Co.'s Augusta Olson 3, Thos. Smith Survey, pumped 14 barrels from Serpentine sand, Lower Cretaceous 563-65 feet, 34-gravity, completed 1-25-55, TD 565.

TEXAS DISTRICT 1—NEW OIL PAY

Frio County, Sand Hollow field. Howeth & Mason's Frieda Kleid Schuchardt et vir 1, Mary Pigford Survey, pumped 19 barrels from Austin Chalk, Upper Cretaceous 4942-5260 feet, 27-gravity, completed 1-15-55, TD 5260.

TEXAS DISTRICT 2—NEW OIL PAYS

Live Oak County, Ramirena, Southwest field. S. H. Howell's Bella S. Freeborn 1, J. M. C. Nixon Survey, flowed 134 barrels from Lower Hockley sand, Eocene 4738-44 feet, 8/64-inch, 41.5-gravity, completed 1-10-55, TD 4818.

Victoria County, Keeran field. Sunray Oil Corp.'s Union-Keeran 11, Martin de Leon Survey, flowed 46 barrels oil and 107 barrels water from 6094-99 feet, 14/64-inch, 35.9-gravity, completed 1-18-55, TD 6500.

TEXAS DISTRICT 2—NEW DISTILLATE FIELD

Bee County. H. R. Smith's Carrie P. Brown 1, W. C. Croft Survey, flowed 2.2 million from Wilcox (Slick) sand, Eocene 6880-86 feet, and 357 barrels distillate and 7.6 million from Wilcox (Mackhank) sand 7178-88 feet, open, 69-gravity, completed 1-6-55, TD 7230.

TEXAS DISTRICT 2—NEW GAS FIELDS

Live Oak County. H. C. Rix' M. W. Marston et al 1, John Turner Survey, ungaged from Jackson sand, Eocene 701-14 feet, completed 11-5-54, TD 1507.

Victoria County, "Salem, Southwest" field. Kirkwood & Co.'s Maggie Heinke 1, IRRCO Survey, flowed 7.5 million from Frio sand, Oligocene 2576-82 feet, open, completed 1-21-55, TD 4515.

Unnamed field. Kirkwood & Co. et al's Paul A. Musselman 1, IRRCO Survey, Section 56, flowed 110 million from Frio sand, Oligocene 3406-10 feet, open, completed 12-24-54, TD 4515.

TEXAS DISTRICT 3—NEW OIL FIELDS

Brazoria County, "Pledger, South" field. Christie, Mitchell & Mitchell's E. W. Brown, Jr. 1, Perry & Austin Survey, Old Well Worked Over, flowed 50 barrels from Frio sand, Oligocene, 6/64-inch, completed 9-26-54, TD 9241.

Hardin County, Fortenberry field. American Republics Corp. & Houston Oil Co.'s H&TC Fee 1, Section 197, H&TCRR Survey, flowed 141 barrels oil and 7 barrels water from Yegua sand, Eocene 6349-53 feet, 7/64-inch, 38.1-gravity, completed 1-3-55, TD 7402.

TEXAS DISTRICT 3—NEW OIL PAYS

Brazoria County, Bonney field. San Jacinto Petroleum Corp.'s Wm. C. Corbett, Jr. et al 2, W. D. Hall League, flowed 165 barrels from Frio sand, Oligocene 7852-58 feet, 8/64-inch, 39-gravity, completed 1-6-55, TD 8015.

"Rowan, North" field. Texas Eastern Production Corp.'s R. A. Louis et al 1, Block 2-A, F. Moore League, Old Well Worked Over, flowed 53 barrels from 9605-18 feet, 12/64-inch, 34.5-gravity, completed 1-10-55, TD 11,501.

Galveston County, Dickinson, Northeast field. Carnes W. Weaver's C. F. Tellefsen et ux Unit 1, A. Edwards Survey, flowed 194 barrels from Big Gas sand, Oligocene 8042-58 feet, 12/64-inch, 35.5-gravity, completed 1-15-55, TD 8867.

TEXAS DISTRICT 3—OIL FIELD EXTENSIONS

Colorado County, Sublime field. Slick Oil Co.'s B. A. Johnson 1, Harvey Morey Survey, ½-mile northeast extension, flowed 53 barrels oil and 50 barrels water from Wilcox sand, Eocene 9465-9500 feet, 13/64-inch, 34.9-gravity, completed 12-21-54, TD 9520.

Fayette County, Arnim field. Farnsworth & Chambers Co. Inc.'s E. A. Arnim 1, John S. Menefee ⅓ League, pumped 25 barrels oil and 58 barrels water from Arnim "A" sand, Eocene 2024-35 feet, 21-gravity, completed 12-20-54, TD 2082.

Hardin County, Karlgore field. American Republics & Houston Oil's H&TC Fee 2, Section 185, H&TC Survey, ½-mile west extension, flowed 78 barrels oil and 25 barrels water from Yegua sand, Eocene 6956-59 feet, 8/64-inch, 41.9-gravity, completed 1-6-55, TD 7706.

TEXAS DISTRICT 3—NEW DISTILLATE FIELD

Harris County, South Bammel area. General Crude Oil Co.'s Wm. M. Hamons 1, Section 7, Block 4, WCRRCO Survey, flowed ungaged distillate and 2.1 million from Yegua sand, Eocene 6610-16 feet, open, completed 12-17-54, TD 7800.

TEXAS DISTRICT 3—NEW DISTILLATE PAYS

Fort Bend County, Hungerford, North field. Lenoir M. Josey, Inc.'s Maxine B. Means 1, Gabriel Cole Survey, flowed 170 barrels distillate and 11.8 million from Yegua sand, Eocene 7099-7164 feet, open, 53-gravity, completed 1-6-55, TD 7530.

Matagorda County, Kain field. Shell's L. W. Kain et al 1, James Duncan League, Old Well Worked Over, flowed 38 barrels distillate and 18.0 million from Miocene "R" sand 6618-23 feet, open, 48.2-gravity, completed 12-13-54, TD 7351.

Kain field. Shell's State Tract 486-1, James Duncan Survey, flowed 20 barrels distillate and 23.0 million from Miocene "L" sand 5189-5208 feet, open, completed 12-18-54, TD 7501.

TEXAS DISTRICT 3—DISTILLATE FIELD EXTENSIONS

Wharton County, West Bernard field. BBM Drilling Co.'s M. Northington 1, Section 15, EL&RR Survey, 1-mile southwest extension, flowed 55 barrels distillate and 3.0 million from Cockfield (EY) sand Eocene 6838-52 feet, open, 54-gravity, and 55 barrels distillate and 2.1 million from Wintermann sand, Eocene 7038-48 feet, open, 60.4-gravity, completed 1-26-55, TD 7684.

West Bernard field. N. B. Hunt's J. D. Hudgins 2, Section 28, Elizabeth McKenzie League, ¾-mile southeast extension, flowed 87 barrels distillate and 7.3 million from Clodine-Yegua sand, Eocene 7104-09 feet, open, 65.4-gravity, completed 1-6-55, TD 7221.

TEXAS DISTRICT 3—NEW GAS FIELD

Wharton County. J. S. Michael's F. B. & Donald Duncan 1, John C. Clark Survey, flowed 50 million from Frio sand, Oligocene 4804-09 feet, open, completed 11-21-54, TD 6389.

TEXAS DISTRICT 3—GAS FIELD EXTENSION

Wharton County, West Bernard field. N. B. Hunt's J. D. Hudgins Unit 1-1, Elizabeth McKenzie League, 1-mile south extension, flowed 2.4 million from 2781-90 feet, open, completed 1-8-55, TD 2946.

TEXAS DISTRICT 4—NEW OIL FIELDS

Duval County, "Sulivan" field. John F. Sullivan et al's Annie Kreis Murphy 1, Section 66, L. Gunter Survey, pumped 58 barrels oil and 14 barrels water from Jackson-Cole sand, Eocene 1850-58 feet, 23-gravity, completed 1-1-55, TD 3665.

Jim Hogg County, "Prado" field. Gorman-Gierhart-Howe's Sarita K. East 1, Section 40, A. V. Prado Survey, flowed 144 barrels from Yegua sand, Eocene 3740-45 feet, 10/64-inch, 34-gravity, completed 12-19-54, TD 4275.

Operators are finding that DIAMONDS REDUCE CORING AND DRILLING COSTS

FORMATION BIT DIA. (IN.)	TOTAL FOOTAGE	PENETRATION RATE	TOTAL COST	BIT COST PER FOOT	BIT LOAD POUNDS PER INCH	DRILLING RPM	CONDITIONS FL. VOL.
WILDCAT FIELD, ROOSEVELT, MONTANA							
Shale, dolomite, lime, anhydrite 6"x2⅜"	1365 ft.	1-4 ft. hr.	$1575.00	**$1.15**	8,000-12,000	60-65	200-300 gpm
WILDCAT FIELD, CHEYENNE COUNTY, NEBR.							
Dakota and shale 6⅛"x3½"	700 ft.	4 ft. hr.	$1072.10	**$1.53**	8,000-14,000	60-70	200 gpm
BISTENAU FIELD, WEBSTER COUNTY, LA.							
Cotton Valley Lime 4¾" HSF	456 ft.	2.8 ft. hr.	$1563.70	**$3.43**	6,000	90-100	130 gpm
KILDARE FIELD, CASS COUNTY, TEXAS							
Shale, lime, sand 4¾" D.C. Drilling	565 ft.	3-4 ft. hr.	$1107.30	**$1.96**	6,000-10,000	80-120	120-130 gpm

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San Patricio County, "Appell" field. W. H. Appell's C. S. Brown 4, M. P. & J. N. Delagdo Grant, Block 15, pumped 57 barrels oil and 24 barrels water from Frio sand, Oligocene 4434-41 feet, 34-gravity, completed 12-13-54, TD 5007.

TEXAS DISTRICT 4—NEW OIL PAYS

Aransas County, Aransas Pass, East field. F. Wm. Carr's O. W. Crow & Martin 1, John H. Phillips Survey, flowed 116 barrels oil and 13 barrels water from Frio (B-5) sand, Oligocene 7310-18 feet, ⅛-inch, 41-gravity, completed 1-18-55, TD 8907.

Duval County, Sejita, East field. Don H. Marsh et al's Otilia Garcia de Olivarez 3, Santa Cruz de La Concepcion Grant, Block 7, pumped 35 barrels from Zone 10-A sand, Oligocene 1268-74 feet, 17.7-gravity, completed 1-9-55, TD 2064.

Nueces County, Viola field. Renwar & Phillips' J. C. Blacknall 4, O. R. Warner Survey 74, flowed 53 barrels oil and 610 barrels water from 4431-35 feet, ½-inch, 24-gravity, completed 12-28-54, TD 4565.

San Patricio County, Spartan field. Spartan Drilling Co.'s Callie Hightower 1, Welder & Odem Subdivision, Block 34, Old Well Worked Over, flowed 64 barrels from Frio sand, Oligocene 8129-32 feet, 8/64-inch, 40.4-gravity, completed 1-3-55, TD 9000.

TEXAS DISTRICT 4—NEW DISTILLATE FIELD

Starr County, Jay Simmons area. Selby-Walker Corp.'s Cornelia B. Rose 1, San Jose Grant, Share 5, ungaged from Vicksburg sand, Oligocene 7454-60 feet, completed 12-15-54, TD 7563.

TEXAS DISTRICT 4—NEW DISTILLATE PAYS

Duval County, Brelum field. Magnolia's Duval-State 4, Section 102, J. Pointevent Survey, flowed 445 barrels distillate and 22.0 million from Wilcox sand, Eocene 7000-25 & 7032-44 feet, open, 60-gravity, completed 1-2-55, TD 7250.

Hidalgo County, South McAllen field. Roy H. Bettis, C. R. Shepherd & W. E. Shriver's John Baldwin 1, Block 4, Hidalgo Canal Co. Subdivision, flowed 45 barrels distillate and 38.0 million from Frio sand, Oligocene 6324-30 & 6336-46 feet, open, 61-gravity, completed 12-9-54, TD 8765.

TEXAS DISTRICT 4—NEW GAS FIELD

Zapata County. Alaska Steamship Co. & Texita Oil Co.'s J. Vela Cuellar 1, Porcion 33, flowed 2.9 million from 4710-20 feet, open, completed 12-15-54, TD 5041.

TEXAS DISTRICT 5—NEW OIL FIELD

Henderson County. Mack Hays, Jr. et al's Mrs. F. E. Cooley et al 1, D. Muckleroy Survey, flowed 149 barrels from Woodbine sand, Upper Cretaceous 3193-98 feet, 14/64-inch, 32-gravity, completed 1-11-55, TD 3194.

TEXAS DISTRICT 5—NEW OIL PAY

Henderson County. Cayuga, Northwest field. Pure Oil Co.'s Stephens Lake Land 1, William Keese Survey, flowed 196 barrels from Rodessa lime, Lower Cretaceous 7436-44 feet, ¼-inch, 43.1-gravity, completed 1-28-55, TD 8190.

TEXAS DISTRICT 6—OIL FIELD EXTENSION

Cass County, Haynes field. R. R. Jackson's Grogan Mfg. Co. 1, Albert Emanuel Survey, flowed 156 barrels from Mitchell sand 5952-62 feet, ⅛-inch, 42-gravity, completed 1-1-55, TD 6008.

TEXAS DISTRICT 7-C—NEW OIL FIELDS

Coke County. A. G. Hill's Ralph H. Harris 2-C, D. H.&H. W. Snyder & W. V. Rosenburg Survey, flowed 276 barrels from Harris sand, Pennsylvanian 5634-67 feet, 16/64-inch, 48-gravity, completed 12-25-54, TD 6500.

Unnamed field. J. B. Randle's F. C. Wotjek 1, Section 406, Block 1-A, H&TC Survey, flowed 304 barrels from Canyon sand, Pennsylvanian 4913-56 feet, 10/64-inch, 43-gravity, completed 12-21-54, TD 5660.

Runnels County, Motley field. Hickok & Reynolds, Inc.'s R. G. Irwin 2, H. C. Wiley Survey, flowed 185 barrels from Missisippian lime 4708-37 feet, 13/64-inch, 44-gravity, completed 1-9-55, TD 4737.

Tom Green County. American Trading & Producing Corp.'s Tom Green County 1, Johann Zerback Survey, flowed 380 barrels from Pennsylvanian sand 5359-71 feet, 24/64-inch, 40-gravity, completed 1-12-55, TD 5829.

Unnamed field. Chambers & Kennedy & El Capitan Oil Co.'s Willis Johnson 1-C, Section 67, Samuel Fitzgerald Survey, pumped 61 barrels oil and 7 barrels water from Strawn sand, Pennsylvanian 5254-58 feet, 41-gravity, completed 12-19-54, TD 5625.

TEXAS DISTRICT 7-C—NEW OIL PAY

Runnels County, Crews, South field. Thomas D. Humphrey & Sons, Ltd.'s Bryan Clayson 6, Block 18, A. Losoya

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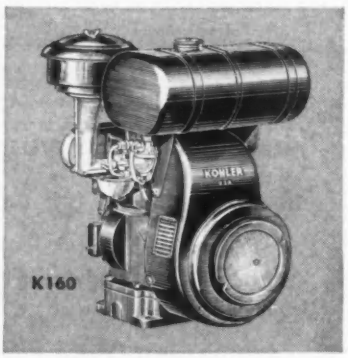
K330.....7 to 12 H.P.
K660 (2 cylinder opposed) 12 to 26 H.P.



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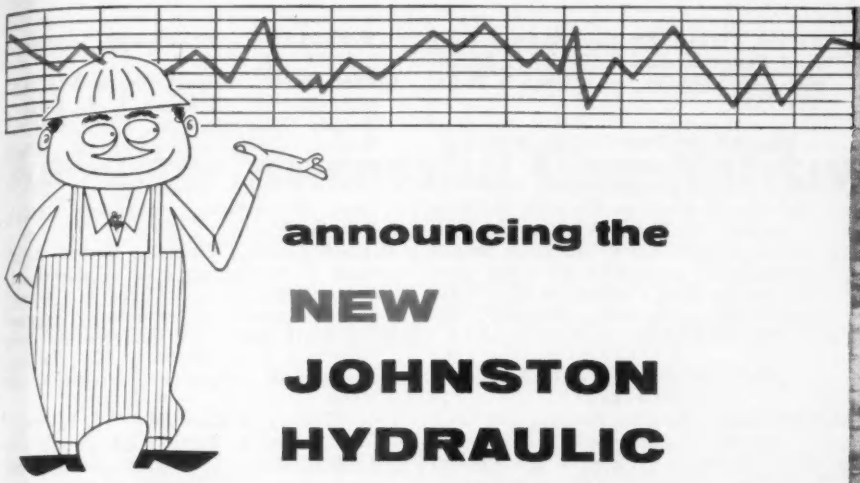

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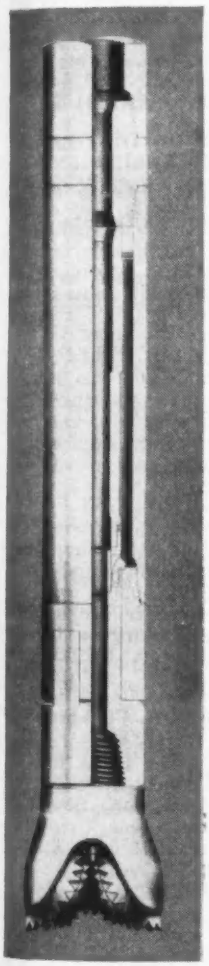

Receiving sub in drilling position — positioned between drill collar and bit. Caliper instrument is dropped or pumped down just prior to pulling out of hole.

Gives you a NEW HIGH in accurate caliper logging — with a NEW LOW in rig time

This latest development of Johnston Testers, Inc., gives continuous measurement and recording of hole diameter, and eliminates drilling-rig down time.

Saves rig time because it eliminates time lost in rigging up and running wire line caliper.

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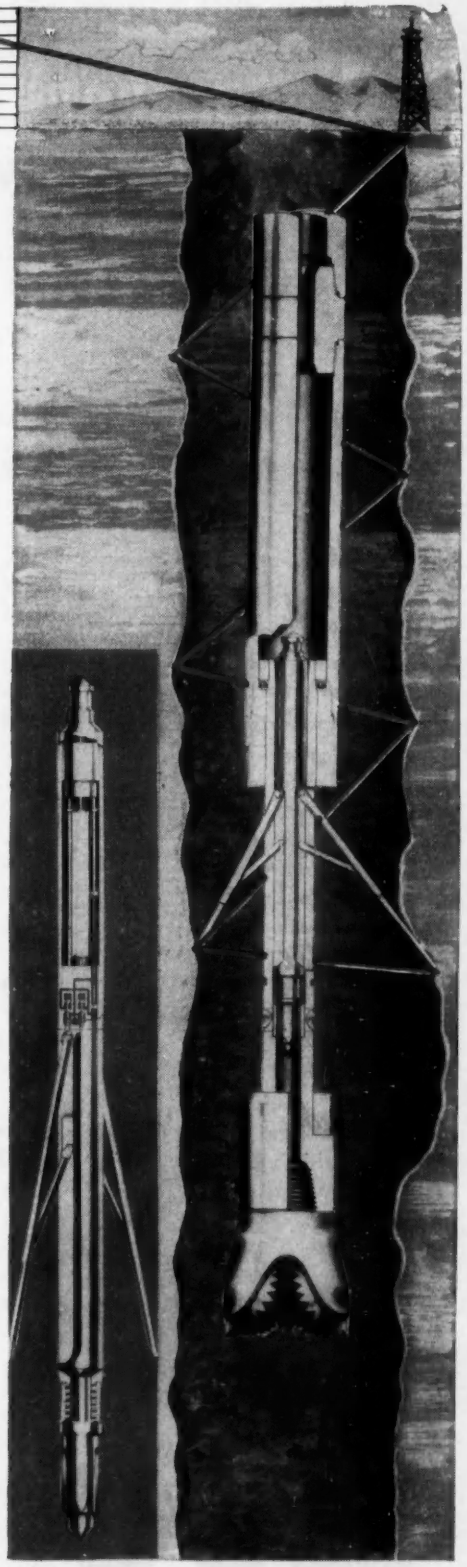

This is the Caliper Instrument with cutaway view of the hydraulic system, clock and chart compartment.

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Survey, flowed 85 barrels from King sand, Pennsylvanian 2165-75 feet, 20/64-inch, 42.9-gravity, completed 1-10-55, TD 2175.

TEXAS DISTRICT 7-C—OIL FIELD EXTENSION

Crockett County, Ozona, North field. Pan American Production Co.'s W. E. West 2, Section 1, Block A, Runnels CSL Survey, ½-mile south extension, flowed 38 barrels oil and 10 barrels water from Ellenburger lime, Ordovician 8060-8203 feet, ¼-inch, 49-gravity, completed 1-3-55, TD 8203.

TEXAS DISTRICT 7-C—NEW GAS FIELD

Sutton County. El Paso Natural Gas Co.'s C. Shurley 1, Section 73, Block C, HE&WT Survey, flowed 3.9 million from Canyon sand, Pennsylvanian 5166-5200 feet, open, completed 12-30-54, TD 6189.

TEXAS DISTRICT 8—NEW OIL FIELDS

Crane County. Gulf's Dawson-State 2-A, Section 12, Block 6, H&TC Survey, flowed 384 barrels from Devonian lime 5168-6722 feet, 42.8-gravity, completed 1-6-55, TD 6722.

Ector County. Sam D. Ares & Curtis & Lomas et al's Ellis Cowden 1, Section 48, Block 42, T-3-S, T&P Survey, Old Well Worked Over, flowed 123 barrels from Wolfcamp lime, Permian 9492-9522 feet, 24/64-inch, 45.5-gravity, completed 1-6-55, TD 14,038.

Pecos County. Vega Oil Corp.'s J. B. Rayner 1, Section 68, Block 10, H&GN Survey, pumped 15 barrels oil and 18 barrels water from Ellenburger lime, Ordovician 4772-4849 feet, 35.5-gravity, completed 1-17-55, TD 4859.

Scurry County. Union Oil Co.'s M. I. Simmons 1, Section 138, Block 2, H&TC Survey, pumped 80 barrels oil and 65 barrels water from Reef lime, Pennsylvanian 6371-85 feet, 43.5-gravity, completed 12-14-54, TD 7320.

TEXAS DISTRICT 8—NEW OIL PAYS

Ector County, Andector, West field. The Texas Co.'s TXL 2-B, Section 9, Block 45, T-1-N, T&P Survey, flowed 242 barrels oil and 52 barrels wate from Clearfork lime, Permian 5708-60 feet, ½-inch, 36.6-gravity, completed 1-21-55, TD 8535.

Scurry County, Fuller field. The Texas Co.'s P. L. Fuller 226-F, Section 551, Block 97, H&TC Survey, pumped 224 barrels from Cisco sand, Pennsylvanian 5309-14 feet, 42-gravity, completed 12-21-54, TD 5314.

TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Andrews County, Fullerton field. Hill & Meeker's Bryant Link Co. 1, Section 7, Block A-48, PSL Survey, ¾-mile west extension, flowed 240 barrels from Clearfork lime, Permian 6920-7056 feet, ¼-inch, 38.6-gravity, completed 12-30-54, TD 7178.

Crane County, Crawar field. The British-American Oil Producing Co.'s J. B. Tubb 1-B, Section 18, Block B-20, PSL Survey, ¾-mile southeast extension, flowed 281 barrels from Ellenburger lime, Ordovician 8233-48 feet, 21/64-inch, 48.5-gravity, completed 1-1-55, TD 8350.

Tucker field. White Eagle Oil Co.'s Elizabeth Reynolds 1, Section 22, Block 3, H&TC Survey, east extension, pumped 63 barrels from McKee sand, Permian 5555-75 feet, 39.3-gravity, completed 1-17-55, TD 6043.

Gaines County, Russell, North field. Ashmun & Hilliard, Ltd.'s A. R. Gillis 1, Section 422, Block G, CCSD&RGNG Survey, 1-mile east extension, flowed 1516 barrels from Devonian lime, 11,018-42 and 11,056-72 feet, 26/64-inch, 38.7-gravity, completed 1-19-55, TD 11,075.

Mitchell County, Coleman Ranch, North field. J. K. Wadley's C. A. Hardee 1, Section 85, Block 97, H&TC Survey, ¾-mile northeast extension, pumped 168 barrels oil and 8 barrels water from Clearfork lime, Permian 3065-86 feet, 25.8-gravity, completed 12-27-54, TD 3086.

Pecos County, Walker field. W. F. Stricklin's White 1, Section 89, Block 194, GC&SF Survey, ½-mile south extension, pumped 35 barrels oil and 5 barrels water from Queen sand, Permian 1885-95 feet, 34-gravity, completed 12-28-54, TD 1895.

Scurry County, Coleman Ranch, North field. C. B. Gray & Victor Salazar's Superior-Autry 1, Section 96, Block 97, H&TC Survey, north extension, pumped 473 barrels oil and 25 water from Clearfork lime, Permian 3082-3107 feet, 26-gravity, completed 1-8-55, TD 3107.

TEXAS DISTRICT 10—DISTILLATE FIELD EXTENSION

Hansford County, Gruver field. R. H. Fulton's L. W. Matthews 2, Section 104, Block 45, H&TC Survey, ¾-mile north extension, flowed 201 barrels distillate and 16.1 million from Morrow sand, Pennsylvanian 6882-6957, completed 1-5-55, TD 7475.

UTAH—NEW OIL FIELD

Grand County. Kimball Oil Co.'s State-Kimball 1, NW NW NE 16-22s-19e, pumped 30 barrels from Morrison sand, Jurassic 1068-1202 feet, completed 11-20-54, TD 1202.

WEST VIRGINIA—NEW GAS FIELDS

Hampshire County. M. E. Anderson's E. W. Dolan Heirs 1, Gore District, flowed 1.7 million from Oriskany sand, Devonian 48.32-55 feet, TD 5026.

Upshur County. George I. Tennant's C. H. Zickefoose 1, Washington District, flowed 1.2 million from 1622-26 feet, TD 1810.

WYOMING—OIL FIELD EXTENSIONS

Niobrara County, Snyder Creek field. E. L. Suagee's Government 1, C NE NE 3-40n-66w, east extension, flowed 75 barrels from Newcastle lime, Upper Cretaceous 7561-71 feet, 24/64-inch, completed 1-5-55, TD 7615.

Park County, Gooseberry field. Mobil Production Co.'s T-36-33-G, SW NE SW 33-47n-100w, ½ mile north extension pumped 198 barrels from Tensleep sand, Pennsylvanian 6240-6400 feet, completed 1-12-55, TD 6400.

Sheridan County, Ash Creek, South field. Shell & J. Ray McDermott's J. V. States 1, NW SW SW 27-58n-84w, pumped 224 barrels from Ash Creek sand, Upper Cretaceous 4571-88 & 4591-98 feet, completed 12-20-54, TD 4626.

WYOMING—NEW GAS FIELD

Sweetwater County. Gulf Oil Corp.'s Federal Unit 1, C NW SW 28-18n-98w, flowed 1.0 million from Lewis sand 5711-6760 feet, ¾-inch, completed 1-12-55, TD 8605.

Keys to Successful Competitive Drilling

A Series on Modern Drilling Technology—Bit Weight and Rotary Speed.

By **ROY A. BOBO,** Director; **ROBERT S. HOCH,** Engineer, and **GEORGE S. ORMSBY,** Engineer, Drilling Engineering Division, Phillips Petroleum Company, Houston

General. The minimum cost of drilling any formation will result from the most advantageous application of these factors:

Bit types	**Bit hydraulics**
Bit sizes	**Rotary speed**
Drilling fluids	**Bit weight**
Drilling equipment	

Compromises must be made regarding bit size and type, type of drilling fluid, and drilling equipment layout as it is economically impractical to change each of these factors for each change in formation. Certain variations may be made in rotary RPM, weight on bit and bit hydraulics since these involve no major change in rotary equipment. This section will consider two of these three variables, rotary RPM and weight on the bit.

Effect of Bit Loading and RPM on Instantaneous Penetration Rate. "Average penetration rate" and "instantaneous penetration rate" are two terms that will be used frequently throughout this section of the report. To avoid misunderstanding, these terms will be defined. "Average penetration rate" is the total footage life of a bit divided by the number of rotating hours. "Instantaneous penertation rate" refers to the rate of downward progress of the bit at some specific instant during the life of the bit. In actual practice, instantaneous penetration rate is obtained by determining the amount of time necessary to drill several inches or several feet of hole under constant drilling conditions.

For example: A bit that drills one foot in ten minutes will have an instantaneous penetration rate of 6 feet per hour; one drilling a total of 40 feet in 10 hours will have an average penetration rate of 4 feet per hour. "Average" and "instantaneous" penetration rates are generally expressed in feet per hour.

The term "weight per inch of bit diameter" is synonymous with $\frac{\text{Weight on Bit}}{\text{Bit Diameter}}$ and hereafter these terms will be often referred to as WPID.

Investigations by others have determined the relationship that exists between bit loading and RPM and their effect upon the instantaneous penetration rate in various formations. In the laboratory and in limited field tests, in formations varying from medium soft to extremely hard, the Hughes Tool Company found the instantaneous penetration rate proportoinal to:

$$(\text{Rotary RPM})\ (\text{WPID})^{K} \qquad (2)$$

Note: ^{K} varies from 1 for soft formations to 2.3 for the hardest formations (cherts and quartzites).

Equation 2 indicates that the instantaneous penetration rate can be increased in most formations by increasing the RPM and/or weight per inch of bit diameter provided the drilled cuttings are removed as fast as they are formed.

The above relationships are valid up to the foundering load, which can be defined as that load sufficient to sink the entire tooth height into the virgin formation being drilled. Theoretically, additional weight on the bit would be supported by the cone body against the formation, decreasing bearing life with no corresponding increase in penetration rate. Below the foundering load, approximately the same instantaneous rates of penetration can be obtained with large and small bits of like type with identical WPID and RPM. Smaller bits, having shorter teeth, will have a lower foundering weight per inch of bit diameter, i.e., will founder at lower penetration rates with the same RPM.

If bottom-hole cleaning action is not complete, a "false" foundering point can be reached. Under this condition, loosened cuttings on bottom support the bit cones and prevent efficient utilization of the weight to force the teeth deep into virgin formation. Very few rigs are equipped with hydraulic systems and/or drill collars sufficient to reach true foundering, while undoubtedly it is very common for rigs to operate at or near false foundering conditions.

Rotary Speeds—Soft Formations. Field drilling data from soft formations on the Gulf Coast have not generally followed Equation 2 as given above. Perhaps the best published information has been presented by Bielstein and Cannon,[1] who showed that doubling RPM sometimes increased instantaneous penetration rate by only 50 percent. Close examination of their data indicates that their results may have been affected to a considerable extent by varying efficiency in bottom hole cleaning. The recent success on the Gulf Coast of increasing hydraulic horsepower at the bit bears out this observation and points up the fact that RPM and WPID relationships to penetration rate (Equation 2) are not valid without consistent bottom-hole cleaning.

In the soft formations found in the Gulf Coast area, rotary speeds as high as 250 RPM have been used. Speeds higher than this can result in premature bearing and tooth

failure with present day equipment and operating conditions. Operators who have used the extremely high rotary speeds in soft formations have often found that reducing rotary RPM and adding drill collars to increase the WPID not only maintains the same high penetration rate but also increases the footage life of the bits.

Regardless of the area, increasing RPM as a means of increasing penetration rate in soft formations will result in an economical increase only if the hydraulic system of the rig is adequate to clean the hole below the bit at the higher rotary speed. The next part of this series will be devoted to bottom hole cleaning action and the rig hydraulic system.

Rotary Speeds—Hard Formations. Increased bit footages will result from reduced RPM in hard and other abrasive formations because slower rotary speeds decrease

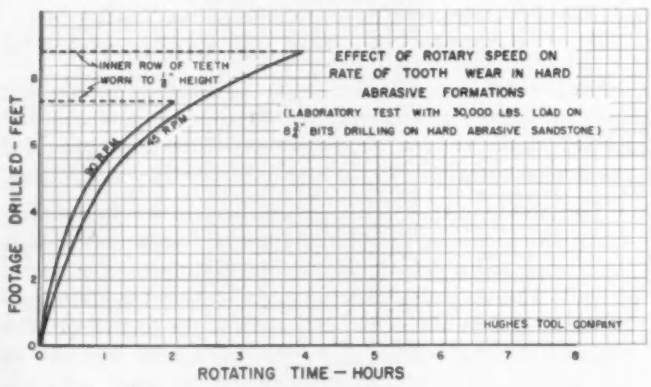

EFFECT OF ROTARY SPEED ON
RATE OF TOOTH WEAR IN HARD
ABRASIVE FORMATIONS
(LABORATORY TEST WITH 30,000 LBS. LOAD ON
8¾" BITS DRILLING ON HARD ABRASIVE SANDSTONE)
INNER ROW OF TEETH
WORN TO ⅛" HEIGHT
90 RPM
45 RPM
FOOTAGE DRILLED - FEET
ROTATING TIME — HOURS
HUGHES TOOL COMPANY

FIGURE 15

the rate of tooth wear per foot of hole drilled (Figure 15). The bearing life of a bit is also improved as rotary speed is reduced because high rotary speeds induce damaging shock and vibratory forces on the rock bit during hard-formation drilling.

Some operators use simple rules of thumb for guides in their rotary drilling practice. One commonly used rule for estimating a safe rotary speed for tricone bits in hard formations is to square the bit size and add 35. From this base figure, the applied bit load (in thousands of pounds) is subtracted. This remainder is the rotary speed. For example: What rotary speed would be acceptable in hard formations for an 8-inch bit loaded to 50,000 pounds?

Answer: Base Figure = (8x8) + 35 = 96; subtract bit load (thousand lbs.) from base figure = 96 — 50 = 46 RPM Ans.

Reducing rotary speed will minimize drill collar joint failures in typical long drill collar strings. Combined shock load resulting from high rotary speeds and the static drill collar load can be sufficient to cause drill collar joint failure after only a few rotating hours. In extremely hard rocks, where long undersized drill collar strings are used (600-800 feet), speeds greater than 75 RPM are generally avoided. In fact, many operators turn their rotary table only 40-50 RPM, as this will not only reduce the possibility for joint failure but will also improve bit tooth and bearing life. On the other hand, in soft formations capable of holding gage, long unstabilized drill collar strings have been run at rotary speeds as high as 150 RPM without incurring premature joint failure. The critical RPM over which premature joint failure occurs is dependent upon the following factors: formation hardness; clearance between collar and wall of hole; collar string-length to collar-diameter ratio; and the relative stiffness and strength of the joint compared to the flexing ability of the collar body.

The exact mechanism of drill string shock from drilling is not known. One plausible theory is that extremely high bit loading, perhaps higher than heretofore thought possible, can greatly minimize vertical string vibration. If tests now planned prove this to be true, present limits on weight and RPM combinations will be changed radically.

Importance of Drill Collar Weight. The trend in all areas is toward increasing the average weight per inch of bit diameter (WPID). In the hard formation areas this is one of the main reasons the present average cost per foot of drilled hole is about the same as it was ten years ago, while all other costs have advanced.

The importance of increasing the load on the bits to increase penetration rates without RPM change can be

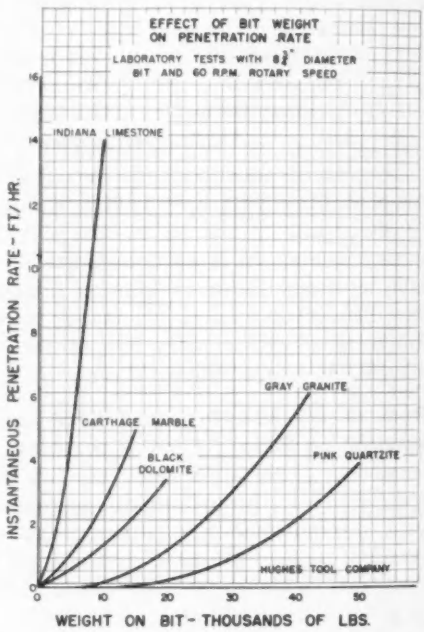


FIGURE 16

observed from the results of the laboratory tests presented on Figure 16. Observe that the penetration rates in the hard and soft formations alike increase rapidly as additional weight is applied to the bit. Because of this important relationship between penetration rate and applied bit load, a miximum economical loading should be applied to be bit at all times.

The drilling operator who fails to provide the optimum drill collar weight for his rigs will penalize himself in any one or a combination of three ways. First, low penetration rates and poor bit footage life will result from inadequate bit loading due to the lack of available drill collars. The second and third penalties—hole trouble and pipe twist offs—will occur when the drillers add more weight on the bit than is available from the drill collars in a conscientious effort to obtain favorable drilling rates. Because of the high tangential forces resulting from rotating a string of buckled pipe, extreme hole damage can occur in soft or sloughing formations when the load on the bit is allowed to exceed the weight, in mud, of the drill collars. Regardless of the effect on the formation, drill pipe damage always occurs under these conditions.

A quick field test may be made readily to determine

whether more drill collars are needed. The driller can obtain instantaneous rates of penetration at several different bit weights while holding other conditions constant. From these data, a curve similar to those in Figure 16 can be plotted for the formation tested. If each increase in bit load up to total available drill collar weight results in a corresponding increase in penetration rate, more drill collars in the string will probably result in an economical increase in bit performance. The added drill collars, properly used, will also result in few pipe twist-offs and less hole trouble.

Optimum Drill Collar Weight Factors. The optimum, or most economical, drill collar weight for a given situation is determined by a number of items, the evaluation of which requires only an intimate knowledge of the rig involved combined with common sense. First, determination must be made by means of a test as described above, or from the experience of other rigs, that more weight on the bit would result in improved bit performance.

The maximum WPID that can beneficially be applied to a rock bit depends upon its size, design, geometry of construction, metallurgy, the degree of stabilization and the formations to be drilled. For some time past, general usage has established a maximum WPID of 5,000 pounds. Recently, a few operators have obtained economical gains with weights approaching double this figure on bits larger than 7⅞ inches. Several operators use a maximum bit load, in thousands of pounds, roughly equivalent to the bit diameter, in inches, squared. By this rule of thumb an 8-inch diameter bit could be loaded to 64,000 pounds. Needless to say, these high weights are used in hard formations with hard formation bits, slow (30 to 40 RPM) rotary speeds, and good "break-in" procedures.

Part 3 of this series presented another method of estimating maximum permissible bit loads for various hard formation bit sizes. It was suggested that "available bearing area per inch of bit diameter" be used as the criteria for this determination. This method assumes that bit life is limited by the bearings and that the maximum permissible load on any given size bit should be based on an equivalent unit bearing load. The three curves in Figure 17 were derived from data presented in Figure 9 (Part 3). The upper curve shows the load that must be applied to various bit sizes to produce a unit bearing load equivalent to that of an 8-inch bit loaded to 88,000 pounds. The middle and lower curves represent an equivalent unit bearing loads comparable to that of an 8-inch bit loaded to 64,000 and 50,000 pounds respectively.

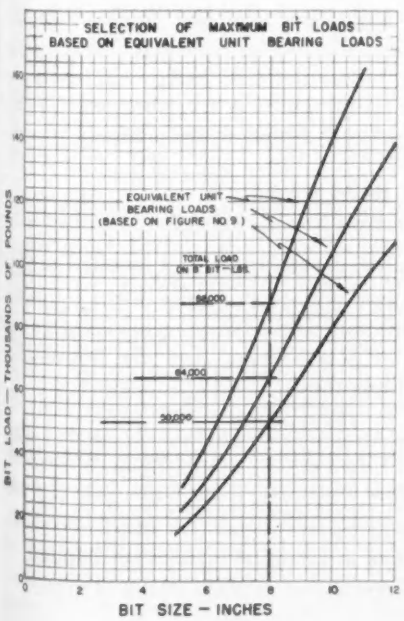


FIGURE 17

The addition of drill collars may not be practiced always with existing rig equipment. For example, the rig may not be capable of handling additional collars because of limitations in the following:

- Rig hoisting capacity.
- Available pipe racking space.
- Available pump horsepower.
- Torque capacity of the rotary table and associated power train.

Also, spending a tour to pick up and lay down additional collars for a short stretch of hole which could be drilled in one or two tours without this extra weight would be impractical. In "fast drilling" formations, a greater percentage of the total time is spent making connections than actually drilling the joint to bottom. Therefore, adding drill collars to improve penetration rate under such conditions should occupy only a position of secondary importance.

To stay within the deviation limits prescribed by the drilling contract, caution must often be exercised against the use of high bit loads in dipping formations. The relationship between hole deviation and bit load has been presented by Woods and Lubinski.[2] "Holding up" on the bit load to prevent hole deviation generally results in reduced penetration rates and bit footages. Because of this, many companies have affected tremendous savings in their drilling budgets by adopting hole deviation policies which are more flexible and realistic than the "fixed type" deviation clause.

The above remarks are not intended to discourage the use of high WPID, but rather to point out the necessity of intelligent planning for it. Certain precautions should be taken when high bit loads are carried. Others have recommended that the drill collar weight, corrected for the buoyancy of the mud, should always exceed the maximum bit load by the equivalent of 10 percent the drill collar string. This will place the neutral point of zero compression and tension safely below the top of the drill collar string. Also, all drill collar joints should be free of fatigue cracks as determined by magnetized field inspection. Regular inspections by field service personnel should be made periodically after a prescribed number of rotating hours depending upon operating conditions.

Method of Applying Bit Weight. Immediate bit damage can occur when the initial bit load is not properly applied. Figure 18 is a typical profile of a bottom hole surface generated by a dull tri-cone bit having extreme wear at the gage teeth (outer circumference) and the spear point (center). Observe that only the gage teeth and the spear point of the new bit will contact the bottom hole surface when drilling commences. Application of all the drill collar load during the first revolution may pinch the bit and break off some teeth.

When a new bit is first put into operation in hard for-

mations, only 1000 pounds or 2000 pounds per inch of bit diameter should be applied with uniform feed rate until several inches of hole have been drilled and a new bottom pattern is established. Even lighter weight should be used where reaming to bottom is necessary. After this break-in period, two schools of thought prevail regarding the method of applying additional weight to the bit. These are described below:

1. **Constant weight method**—Apply a maximum load to the bit and maintain this load until the economical bit life is reached. The economical life of a bit can be determined in homogenous formations (constant rock condition) by keeping an account of what the cost would be for that bit if it were pulled after 4, 5, 6,—15, 16, etc., hours using Equation (1) or Figure 5 (Part 1). When the cones lock or the cost per foot stops decreasing or begins to increase, the economic bit life has been reached and it should be pulled immediately.
2. **Increasing weight method**—Begin drilling operations with 3000 to 4000 pounds per inch of bit diameter. As the teeth dull and become more capable of transmitting the drill collar load to the formation, increase the weight on the bit until maximum permissible loading is reached. One or two hours are generally adequate to progressively increase the bit load up to maximum value. The bit should be pulled when the cones lock or when the economic bit life has been reached.

The constant weight method generally is preferred while drilling the softer formations and when low bit weights are used. In hard and brittle formations the increasing weight method will generally result in greater bit footages. Using the constant weight method, premature tooth failure can occur if the initial load on these sharp teeth is too high.

Effect of Bit Weight Stabilization on Bit Performance. Oversized drill collars and drill collar stabilizers are becoming popular in hard formation areas since their use has resulted in straighter holes and longer bit life. The reason for drilling a straighter hole with such equipment is apparent. The increase in stabilization of the drill collar string usually results in better distribution of weight on the cones and an accompanying increase in bit life. A long slender or conventional string of drill collars will buckle and become unstable from the effects of columnar loading. At any given instant during a bit revolution one or two of the cones on either a three or four cone bit can carry more than their share of the load if the axis of the bottom drill collar revolves about the axis of the hole.

In hard formations it is possible for two of the cones to carry all of the bit load. This can be illustrated in Figure 19. Note that a 1-degree tilt of the drill collar axis from the axis of a 10-inch hole will lift one cone of a tricone bit .0135 inch off bottom. Should the amount of formation removed per bit revolution be less than .0135 inch, two of the cones can theoretically carry all the bit weight. This condition could exist at low rates of penetration depending upon the rotary speed. For instance at a rotary speed of 75 RPM and at penetration rates less than 5 foot per hour, there will be less than .0135 inch of formation removal per bit revolution (see Figure 8 Part 2).

The effect of unequal cone weight distribution upon the life of the rock bit will be less significant when drilling under the following conditions:

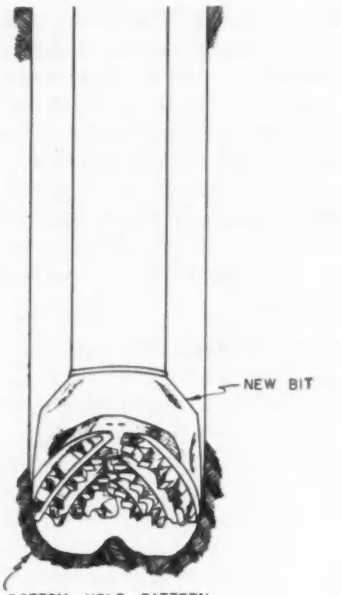


FIGURE 18

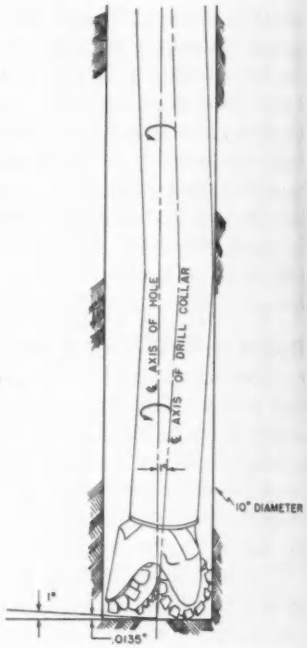


FIGURE 19

- In soft formations.
- With small bits.
- With low bit loads.
- With large diameter drill collars.
- With low rotary speeds.
- In highly deviated holes.

When a drill collar string operates at low rotary speeds in deviated holes having low coefficients of friction between the pipe and hole wall, it will tend to lay along the low side of the hole. This will tend to distribute equally the bit load among the cones.

Effect of Bit Weight and Rotary Speed on Bit Bearing Life. The relationship which exists in the field between rock bit bearing life, applied load, and RPM has not been determined; however, for a given drilling fluid and set of operating conditions, a rock bit bearing will turn only a certain number of bit revolutions before it fails. Generally, the higher the load and/or speed applied to the rock bit bearing, the shorter will be the bearing life in hours. In limited laboratory tests using water and low solids drilling fluids containing very few abrasives, the life of a rock bit in hours was found to be inversely proportional to:

$$\text{RPM} \times \text{load}^{2.6}$$

These tests assumed that the life of a bit ended after .030 inch of pin bearing wear.

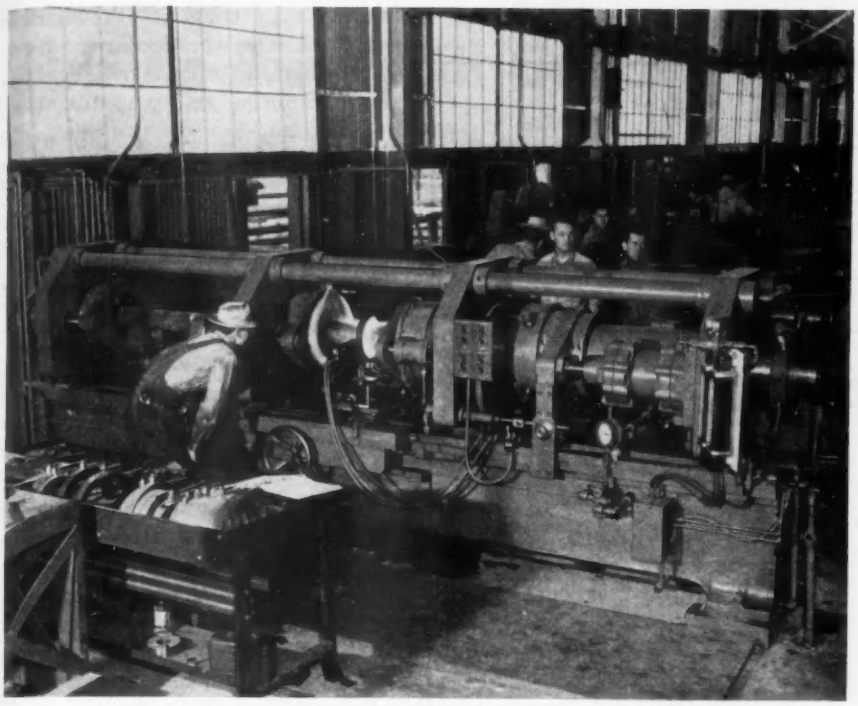
In downhole operations, bearing life does not conform with the above idealized equation because of the following factors: Vibratory forces resulting from rotary speed, tooth action, degree of bit stabilization, and the lubricating properties of the drilling fluid.

REFERENCES

1 "Factors Affecting Penetration Rate of Rock Bits" presented at Spring meeting of Southwestern District API Division of Production, Dallas, March, 1950.

2 "Problems in Hole Deviation" by H. B. Woods and Arthur Lubinski, API Mid-Continent District meeting, Oklahoma City, March 18, 1954.

This is Part 4 of a series of articles on Modern Drilling Technology. Part 5 of this series will appear in an early issue.



PRESSURE WELDING MACHINE STUB ENDING A COLLAR

Stub Ending Drill Collars By Pressure Weld Technique

• The application of the process to the salvage and repair of used drill collars.

• The types of repairs possible, methods used in the preparation, and performance of actual weld.

By **J. L. DICKMAN,** Chief Engineer,
Baash-Ross Tool Company, Los Angeles

STUB-ENDING of drill collars—welding a short section or stub to one or both ends of the shortened collar—has become a common practice. It probably gained first prominence in West Texas where as many as 18 to 28 drill collars were employed in the drill string. In such instances, collars formed an appreciable percentage of the over-all equipment cost and any economies that could be effected toward repair or salvage of worn collars represented sizable savings. Proper stub-ending of collars, it was found, could satisfactorily accomplish any of the following desirable repairs: 1. restore a worn collar to original outside diameter; 2. restore a short collar to original length; 3. maintain proper pin length; and 4. provide additional material strength.

In order to distinguish the pressure, or solid phase welding method from other types of welding, the following three classifications of welds are given:

• **Liquid-Solid phase,** which consists of welding two members by means of filler metal having a lower melting point than either of the parts to be joined, such as in brazing.

• **Liquid phase,** or fusion welding, in which the adjoining surfaces of the base metal in the weld members are melted, either with or without addition of other molten metal, such as in arc, gas or thermit welding.

• **Solid phase,** which is defined as the process by which members are bonded by nuclear forces without the presence of a liquid phase at any stage of the process.

Briefly, the solid phase consists of forcing the prepared weld members into engagement under hydraulic pressure, applying the proper degree of heat and upsetting the steel bridging the weld section. The initial preparation consists of accurately machining both the drill collar and stub to the general contour shown in Figure 1. The interface is machined perfectly square with the common axis to exclude entrapment of oxygen and subsequent formation of undesirable oxides in the weld. Both members then are clamped in the welding machine which, basically, is a horizontal hydraulic press. The drill collar is held in a hydraulically actuated, stationary collet, while the stub member is clamped in an opposing movable collet, traverse of the latter being controlled by two hydraulic pistons operating on a 1000 pounds per square inch system. Midway between them, the heating torch is mounted on a carriage resembling that of a lathe. The torch consists of two semicircular members having a multiplicity of flame ports and is internally water cooled.

Prior to welding, alignment of the interface is checked by taking an impression on a suitable paper, after which any necessary adjustments are made to assure perfect alignment. After making all predetermined settings of flow meters controlling flow of oxygen and acetylene, checking for proper size of heating torch, amount of axial upset required, hydraulic gage pressures and approximate time of the weld, the interface is carefully cleaned with a suitable solvent, such as ether or acetone and pressed together under an initial pressure. Depending upon material strength at the elevated welding temperature, this pressure may range from 2500 to 4000 psi.

The heating torch is lighted and circumferentially reciprocated around the interface at medium speed. As the material at the interface reaches a

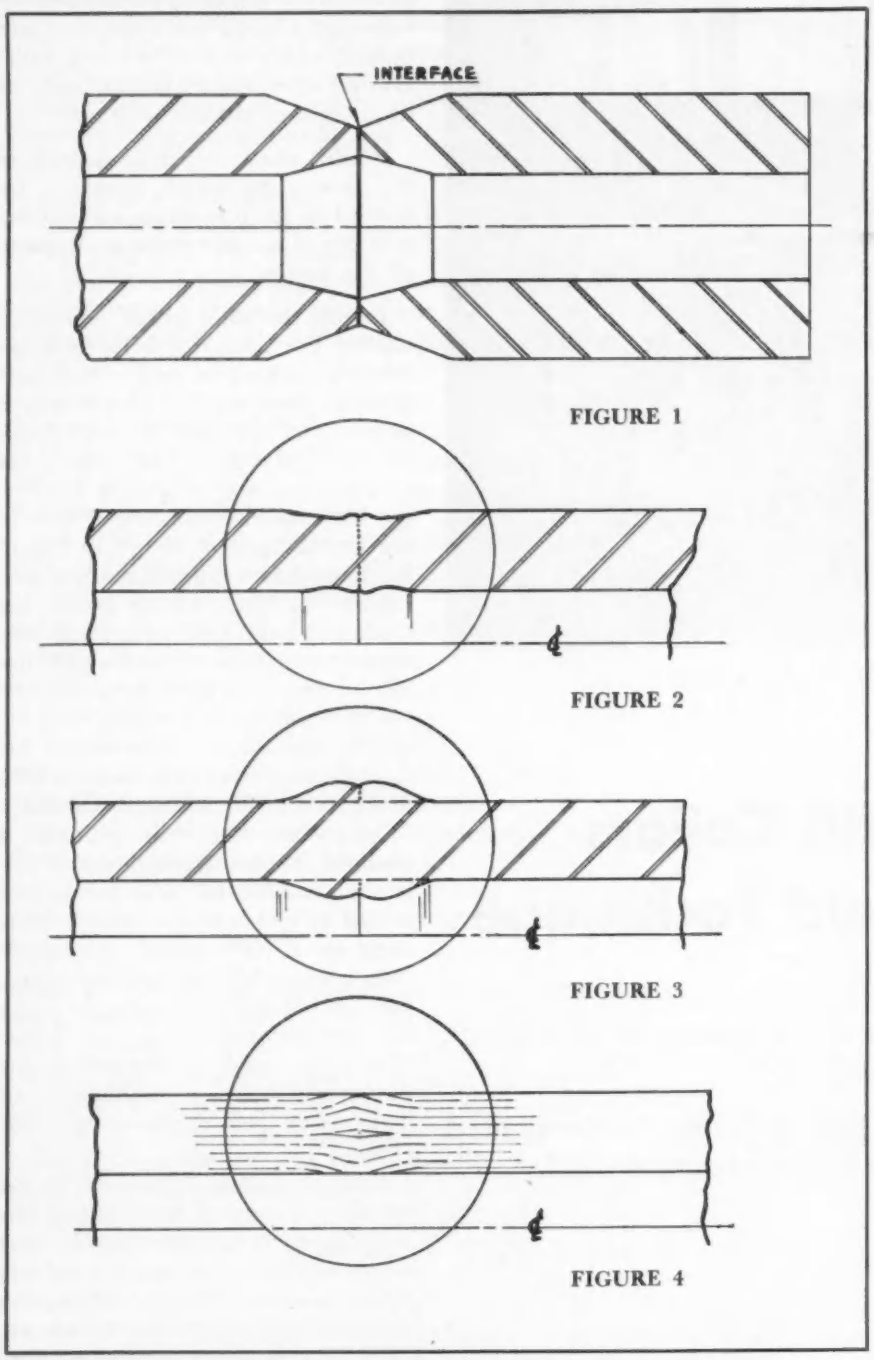


FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4

CROSS-SECTION OF DEVELOPMENTS DURING PRESSURE WELDING

proper forging temperature, in this case approximately 2200° F., it will begin to upset, as shown in Figure 2. Bonding of the metal or weld has actually occurred at this time. Under the influence of proper pressure and temperature and without raising the metal above the solidus temperature, the atoms have diffused across the interface and intermingled with those of the opposite member forming a completely homogeneous mass.

As a further precaution, application of heat is continued and, as upsetting progresses, the mechanism of the machine imparts a longitudinal, reciprocating movement to the torch, in addition to the circumferential motion. The amplitude of the longitudinal motion is gradually increased, causing the upset section to lengthen, and the reciprocation correspondingly is increased. When the form shown in Figure 3 is reached, the limit switch automatically shuts off the machine and torch. The work is allowed to cool in air, then the torch is re-lighted and the weld normalized to approximately 1650° F. and again is air cooled. This normalizing operation relieves any stresses induced during welding and also refines the grain structure of the weld. The upset then is machined off the outside diameter and the bore, removing the material containing the original interface as indicated by the dotted lines of Figure 3.

The weld is carefully inspected by the magnetic particle method. Subjecting welds formed in this manner to a variety of mechanical tests has demonstrated that ultimate tensile and yield strengths of the weld were slightly higher than values for the parent metal in the normalized condition. Available test data[1] definitely establishes the excellence of pressure welds and accounts for the acceptance of this type weld by the aircraft industry.

It is believed the pressure welding technique is superior for the following reasons: (1) material at the weld is completely homogeneous and without slag inclusions or gas pockets; (2) grain growth is reduced to a minimum, hence improved material strength; (3) additional working of the metal during upsetting produces an extremely desirable structure across the weld; (4) minimum of internal stresses are developed due to mild heat applied; and (5) process is equally adaptable to high or low hardenability steels of varying carbon or alloying content.

Over the past few years thousands of collars have been repaired in this manner and have rendered entirely satisfactory service under the most rigorous of drilling conditions. The drilling industry, in general, is now accustomed to accepting stub ending by such a reliable method and it has proven to be a most valuable asset, both practical and economical, in the constant endeavor toward curtailing the trend of increased drilling costs.

REFERENCE

[1] "Fatigue Strength of Welded Aircraft Joints," by T. V. Buckwalter and O. J. Horger. *The Welding Journal Research Supplement*, IX, 1944.

ACKNOWLEDGMENT

To W. J. Williams, works manager, Baash-Ross Tool Company.

This article is a condensation of a paper by J. L. Dickmann, chief engineer, Baash-Ross Tool Company, Los Angeles, presented at the Petroleum Mechanical Engineering Conference, September 27-29, 1954, of the American Society of Mechanical Engineers.

Stub Ending Drill Collars By Electric Arc Technique

• This relatively new idea was first used successfully in the Mid-Continent in the mid 1940's.

• It was brought about by the use of long strings of drill collars in hard rock country.

By W. S. BACHMAN
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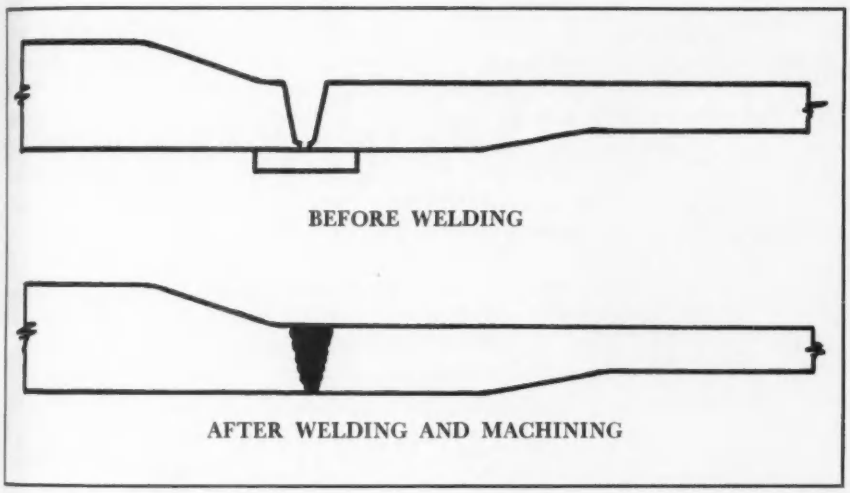

Fig. 1—Early attempts to weld tool joints to drill pipe by Ferrule weld method.

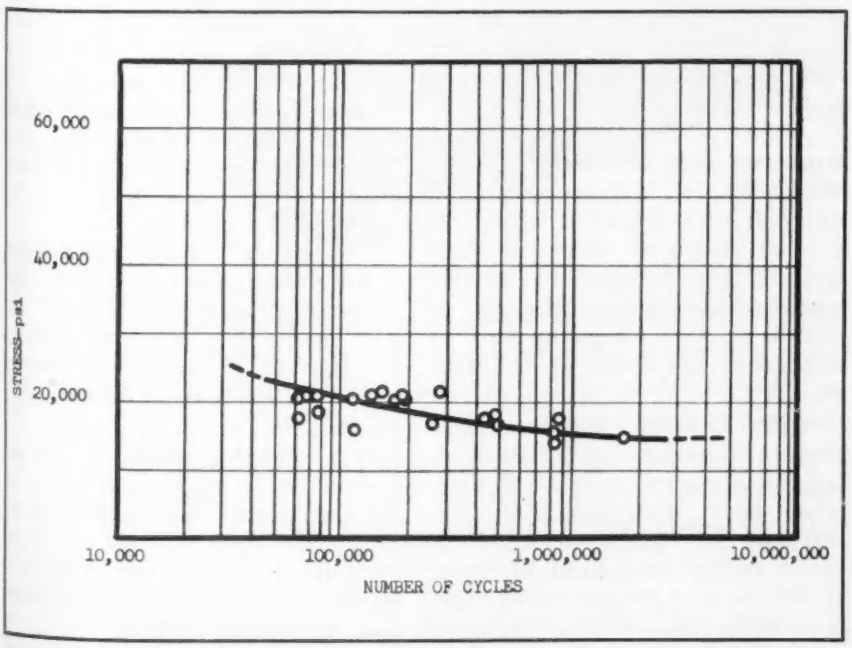

Fig. 2—Fatigue curve—hand-weld connections—failures in weld. (Reproduced from Reference 1.)

THE IDEA of electric arc welding stubs on drill collars is relatively new. In the Mid-Continent, the first large number to be welded successfully was done in the middle 1940's. This repair practice was brought about by the use of long strings of drill collars in the harder rock country. In using long strings to apply more weight on the bit, the number of connection failures due to fatigue increases greatly and the drill collars shorten in length relatively fast as new connections are cut on the ends. A drill collar approximately equal to a joint of drill pipe in length is needed so a stand of two or three collars will reach the board in the derrick during trips to change the bit.

The forerunner of stubbing drill collars dates back to the early 1930's to the attempts that were made to weld drill pipe to tool joints by the hand weld method. After extensive laboratory and field tests, it was found that a ferrule-type weld was the most satisfactory from a strength standpoint. An illustration of one of these first ferrule-type welds is shown in Figure 1.

Strength of hand-welded drill pipe to tool joint connection. A study of the fatigue strength of ferrule-type hand welds will show why this method of welding later proved satisfactory on drill collars, but was not particularly successful on tool joints.

A large number of full-size rotating beam fatigue tests were made on welded drill pipe sections in the laboratory by one of the major manufacturers.[1] The results of these tests is shown in Figure 2. It may be noted that the fatigue stress to cause failure in the weld at 1,000,000 cycles is ap-

Fig. 3—Bore built up with weld before machining for back-up plug or ferrule.

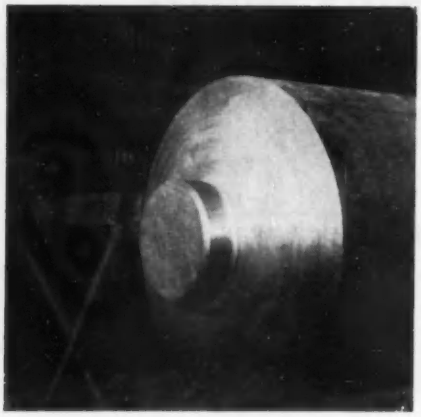

Fig. 4—Machined end of drill collar with plug inserted.

Fig. 5—Drill collar in preheater prior to welding.

proximately 15,000 pounds per square inch.

The factor of safety of a tool joint-to-drill pipe connection is based on the strength of the body of the pipe. It has been found from full-size fatigue tests on drill pipe that the fatigue strength of the body of the pipe varies from a nominal 27,000 psi to 32,500 psi for the best run to be expected. Using 4½-inch 16.60 lb./ft. grade D drill pipe, for example, it can be calculated that the factor of safety of the connection over the pipe varies from slightly over 1.0 to less than 1.0 for pipe with commercially available upsets on the ends (see Appendix 1). This would mean some failures at the joint rather than in the body of the pipe. Therefore, other methods of welding which have higher fatigue strengths in the welds are necessary on drill pipe.

Strength of hand-welded drill collar sections. On drill collars the problem of fatigue strength of the welded sections is unlike that of drill pipe in that the welded section must have a factor of safety over the pin and box connection strength, not the body of the drill collar. The pin and box connection is the weakest member of the drill collar string. As the weld sections are quite thick, a relatively low fatigue strength in the weld section will produce favorable factors of safety over the connection strength.

For example, a 6¼-inch outside diameter x 2¼-inch bore drill collar with 4½-inch API full hole connections has a factor of safety in the weld section over the connection strength of 1.25 to 2.42 if a good weld, reasonably free of defects, is obtained[2] (see Appendix 2).

A good welding technique is essential. The weld must be free of holes and slag inclusions. Proper chipping of the flux off the weld between each pass cannot be emphasized too strongly. Generally a rod with a low hydrogen type of coating is recommended although other types of rod can be used if the proper preheat is applied to the sections to be welded.

Some of the welding rods checked were specified by the manufacturers to have strengths in excess of 100,000 psi but after making a thick weld a number of these failed at lower pressures. Where pure tensile strength is not too much of a factor because there is a large cross section area at the weld, these softer welds have an advantage from a fatigue standpoint over harder, more notch sensitive materials.

Improved rods available. During World War II high strength weld materials were developed which did did not anneal so readily in thick deposits. Two different rods of this type checked seemed to be similar in that a relatively large amount of manganese was found in the weld deposit.

Although there is not a large amount of fatigue data available on large size specimens welded with these newer, higher strength rods; the several tests that have been made indicate a fatigue strength of 17,000 to 18,000 psi at 1,000,000 cycles. This is a slight increase over the older cenventional rods.

From the above data it readily becomes apparent that the more important elements in stubbing drill collars by the arc welding methods are the welding techniques, the preheat, the stress relief after welding, and the design of weld rather than the welding rod as long as a high quality rod is used.

Preheating weld. Proper preheating and stress relieving of the weld cannot be overemphasized. As a general practice, a preheat of 600° to 800° is advisable. This temperature should be checked frequently. When several beads are run, only a small amount of external heat is required if the welder continues to weld and chip the slag until the stubbing is completed. Although it is possible to weld the AISI 4140 alloy steel normally used in drill collars with a low hydrogen rod at preheats less than 600° and have no external cracking, the high thermal gradient between the weld and the drill collar would certainly increase the residual stresses in the weld and heat affected zone.

The preheat reduces the amount of martensite formed adjacent to the weld in the heat affected zone of the base metal. The minimum amount of formation of this brittle material in the weld zone is very important.

Stress relieving weld. To get an idea of the residual stress set up in the weld during welding, the gap on the outside of the weld will sometimes close up as much as one-eighth inch between the time the starting bead and the final bead is run.

A stress relief after welding of 1200° with a soaking time of two to

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Fig. 6—First bead run in weld.

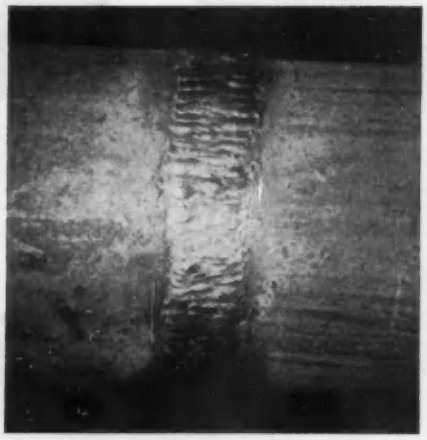


Fig. 7—Finished weld.

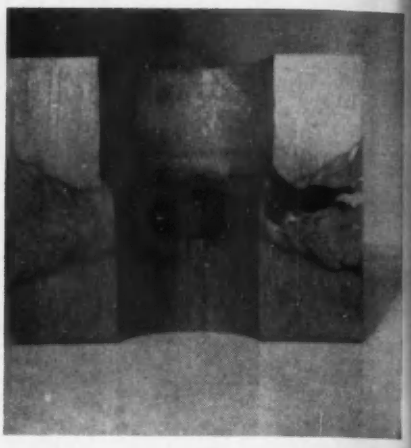


Fig. 8—Weld failure showing pin holes in weld and crack leading into weld from the bore.

four hours is strongly recommended. The rate of cooling should be fairly slow. In most cases the collars are allowed to cool to 300° to 400° in the furnace when the heat is cut off.

Making the weld. Figures 3 through 7 show the steps necessary to make a weld using a ferrule or a plug for a back-up. It is advisable to first build up the bore at the end of the collar with weld metal after preheating as shown in Figure 3. As a result of circulation of mud during drilling, the bore of an old collar will usually be washed ⅛ inch to ¼ inch greater than the original bore. The diameter of the original bore or less is desirable to provide additional connection strength if the drill collar is stubbed on the pin end. The bore is not so critical if the drill collar is stubbed on the box end.

After the inside diameter of the collar is built up, the weld is machined to slightly less than the new bore and a drive fit plug or ferrule is made and forced into the end of the collar, Figure 4. If both ends of the collar are to be stubbed, a ferrule should be used on at least one end to allow heated gases in the bore to escape. The plug should also be force fit into the bore of the stub.

The drill collar should then be preheated. A portable gas preheater is shown in Figure 5. The weld area should be held at the preheat temperature during the entire time the weld is being made. In some cases a groove is cut in the plug or ferrule for the first bead. This insures that the first bead is completely removed when the bore is machined out. Figure 6 shows the first bead. When the weld is completed, as shown in Figure 7, at least one additional layer of beads has been run on the OD of the collar. These beads are machined off to eliminate rough weld surface defects and to anneal the material immediately below the surface of the drill collar.

After all welding is completed, the welded section of the collar is placed in a furnace and stress relieved. After stress relief the ferrule is machined out, removing the first bead, and the OD is turned removing the last beads.

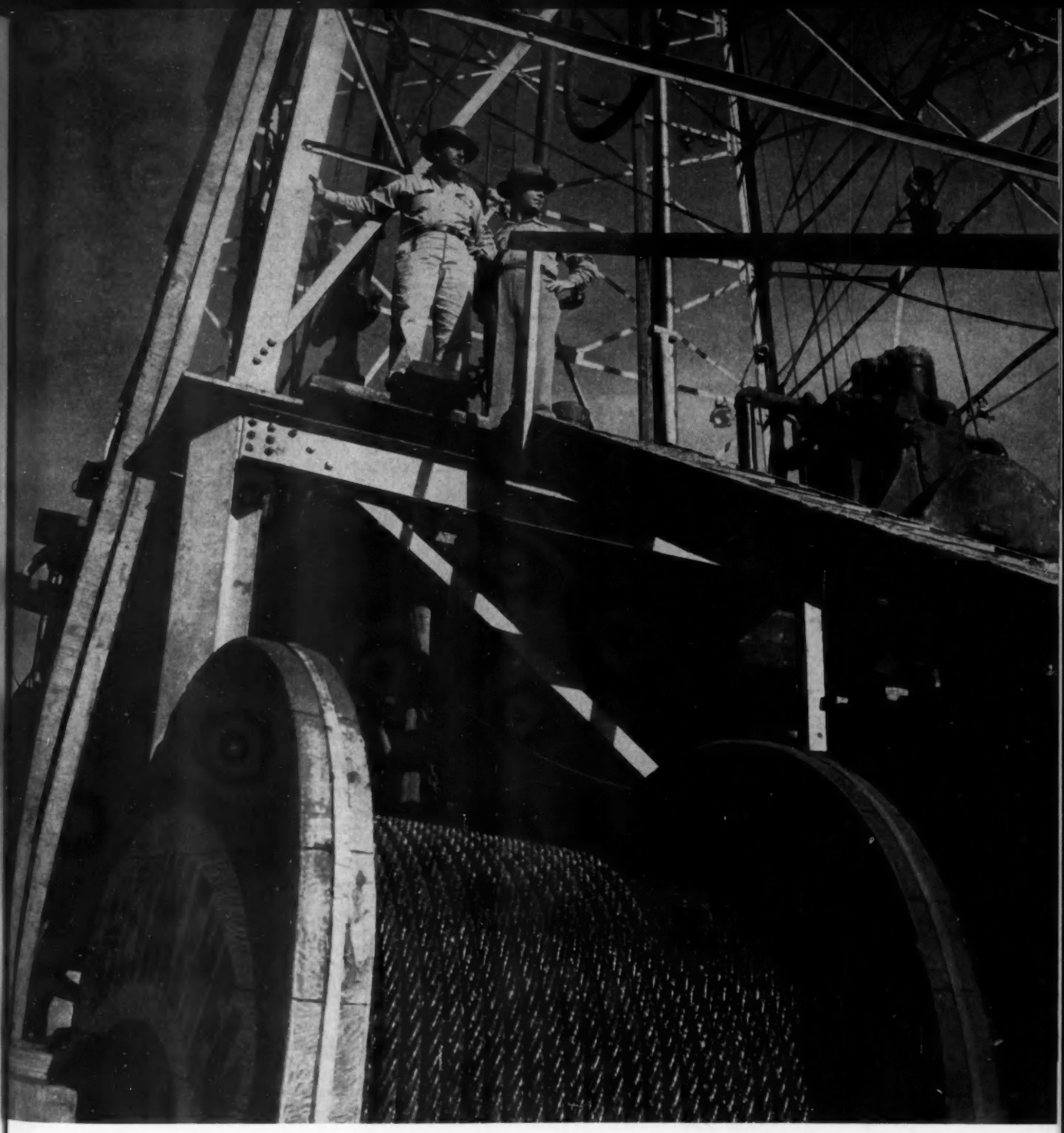
Field failures in welds. Almost without exception, failures in stubbed drill collars are due to poor welds. Figure 8 shows a failure or "wash-out" in a weld with numerous pin holes and slag inclusions. Also, the ferrule, which was made integral with the stub, was not machined out. In effect there was a crack to the first bead by virture of the design itself.

Fig. 9—Weld failure where back-up ferrule was not used.

Figure 9 shows a crack starting in the first bead when no back up plug or ferrule was used. Both the possibility of a crack originating in the first bead and the reduction of area at the welded section condemn this weld.

Summary.

1. The fatigue data available on thick hand-welded sections indicates that satisfactory stub welds can be made at field machine shops with reasonable factors of safety over the strength of the drill collar pin and



Wire Rope at Work—This is Falcon Seaboard's Rig No. 12, photographed on a deep-hole job in St. Martin Parish, St. Martinville, La. When the picture was taken, drilling had pushed beyond the two-mile level.

Falcon Seaboard's No. 12 is a big outfit, capable of managing very heavy loads. So much depends upon the wire rope that unusual care is exercised in its selection and maintenance. Here the choice was 3500 ft of Bethlehem Purple Strand, 6 x 19 construction, 1¼-in. diam—Form-Set (preformed) for easy handling. Added strength and resistance to crushing were assured by an independent wire rope core. This combination provided a generous margin of reserve, and helped the rig meet every load condition very comfortably.

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box connection if proper welding procedures are used.

2. A number of weld materials are satisfactory if the weld is free of inclusions or defects.

3. Proper preheat and stress relief are very essential to the success of arc welded drill collar stubs.

4. A proper design using a back-up plug or ferrule to eliminate the first bead and provide a smooth bore is advantageous.

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ACKNOWLEDGMENTS

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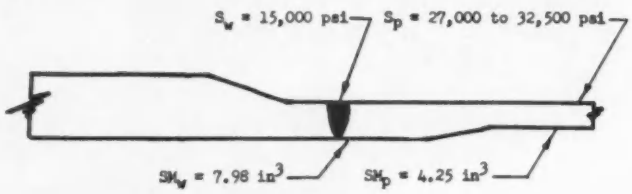


APPENDIX 1

Fatigue strength of the body of drill pipe as compared to hand welded section between tool joint and pipe.

Weld Section

$BM = SM_w \times S_w$
$= 7.98 \times 15{,}000$
$= \underline{\underline{120{,}000}}$ lb-ins.

Body of Pipe

$BM = SM_p \times S_p$
$= 4.25 \times 27{,}000$
$= \underline{\underline{115{,}000}}$ lb-ins. (nominal fatigue limit)

$BM = 4.25 \times 32{,}500$
$= \underline{\underline{138{,}000}}$ lb-ins. (best run to be expected)

Factor of Safety

(hand weld compared to body of drill pipe)

$F.S. = \frac{120{,}000}{115{,}000} = \underline{\underline{1.04}}$ (nominal fatigue limit)

$F.S. = \frac{120{,}000}{138{,}000} = \underline{\underline{.88}}$ (best run to be expected)

Where

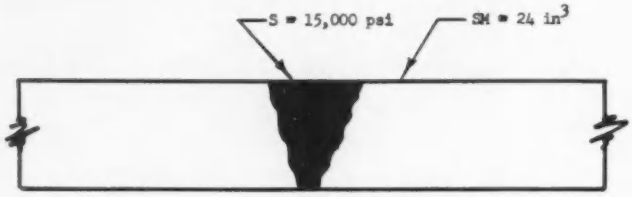
BM — Bending moment to cause failure at 1,000,000 cycles in lb-ins.

SM_p — Section modulus of body of drill pipe in in^3.

S_p — Fatigue failure stress at 1,000,000 cycles in body of 4½" 16.60 lb/ft drill pipe in psi. (see ref. 1)

SM_w — Section modulus of upset of drill pipe in in^3.

S_w — Fatigue failure stress at 1,000,000 cycles in weld area in psi.



APPENDIX 2

Fatigue strength of drill collar welded section as compared to drill collar pin and box strength for 6¼ OD × 2¼ inch bore drill collar.

Weld Section

$BM = SM \times S$
$= 24 \times 15{,}000$
$= \underline{\underline{360{,}000}}$ lb-ins.

Where:

BM = Bending moment to cause failure at 1,000,000 cycles in lb-ins.

SM = Section modulus of body of drill collar in in^3.

S = Fatigue failure stress at 1,000,000 cycles for welded section of 4½" 16.60 lb/ft grade D drill pipe in psi. (see ref. 1)

Connection Strength—4½" API Full Hole tool joint in 6¼" OD × 2¼" ID drill collar. (see curves in ref. 2)

BM = 148,800 lb-ins. (conventional 4½" API FH tool joint)

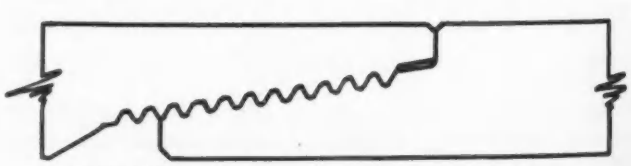
BM = 288,000 lb-ins. (for best relief groove design in 4½" API FH tool joint)

The above values are based on failure of joint at 1,000,000 cycles.

Factor of Safety

(hand weld compared to joint strength)

$FS = \frac{360{,}000}{148{,}800} = \underline{\underline{2.42}}$ (Conventional design)



$FS = \frac{360{,}000}{288{,}000} = \underline{\underline{1.25}}$ (best relief groove design)

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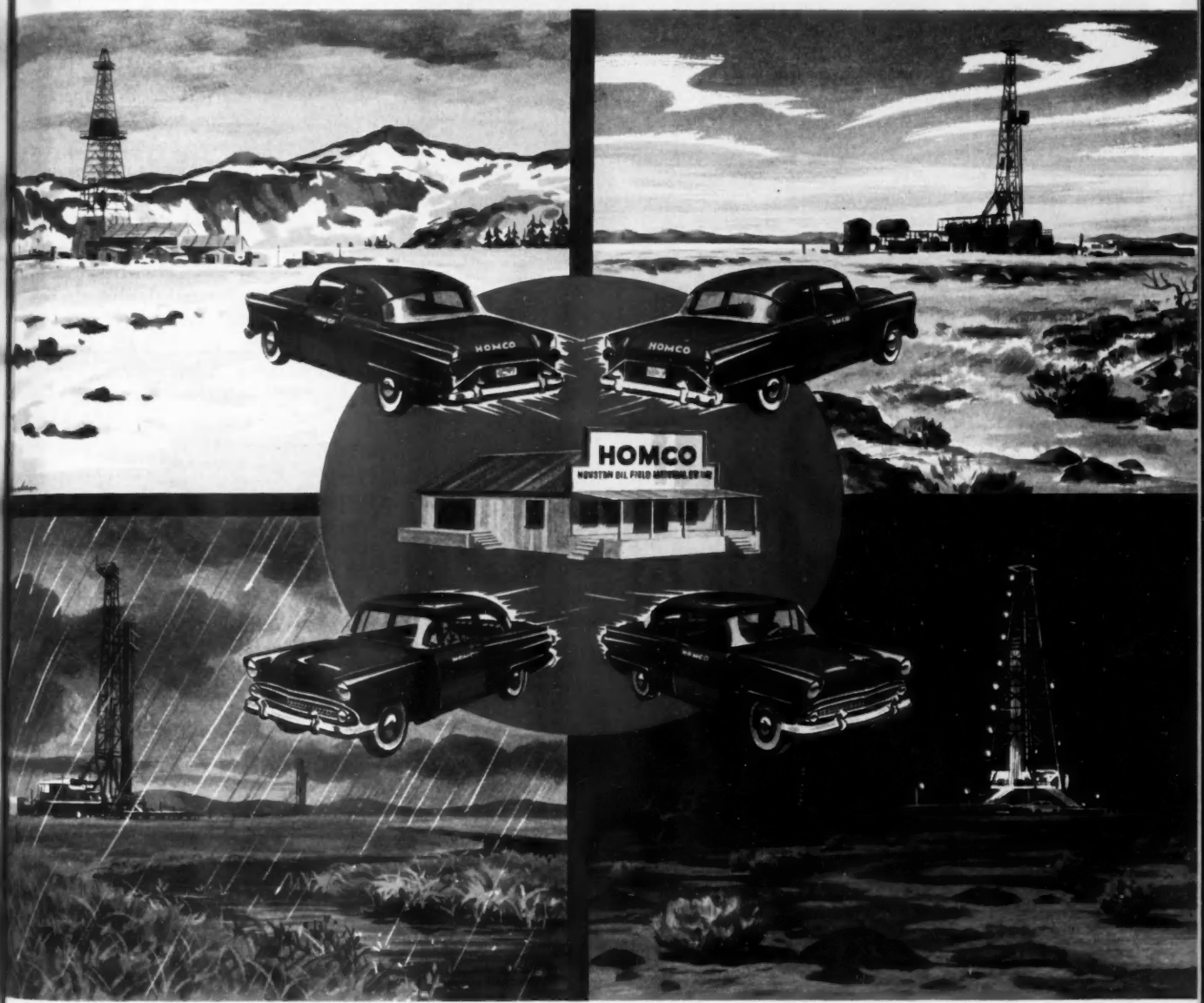

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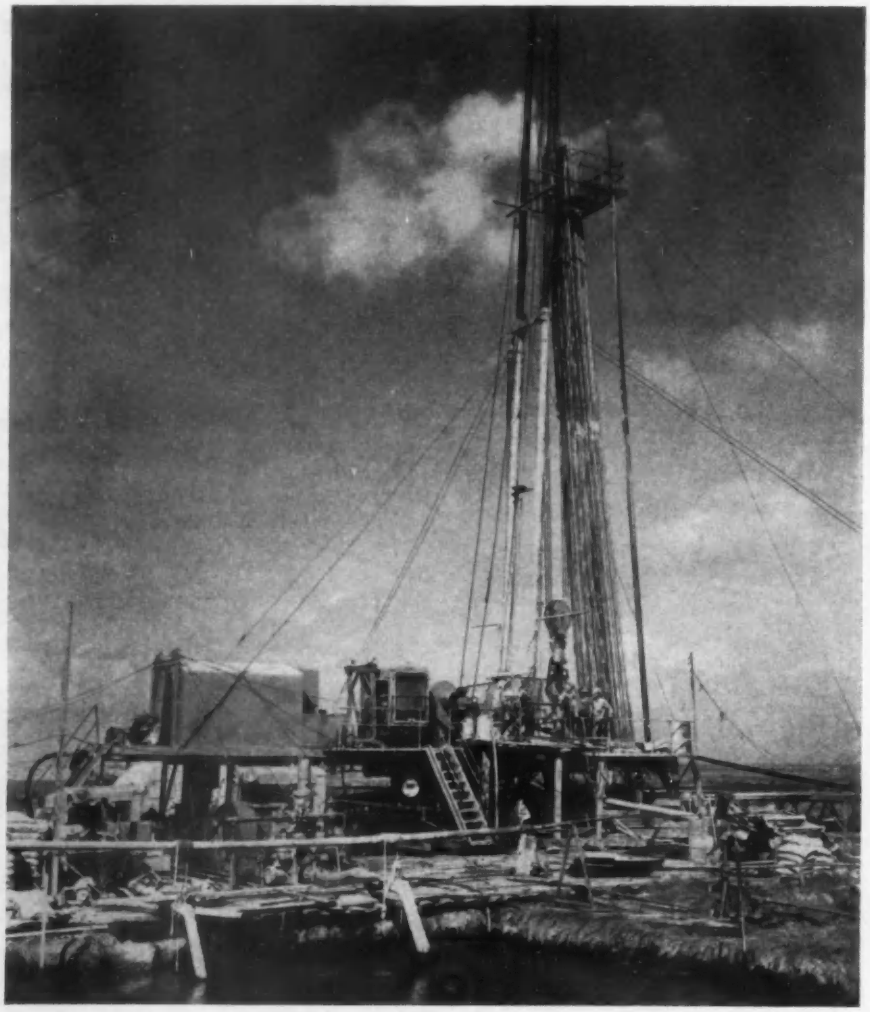

GENERAL VIEW of the double gin pole rig used to drill 9800 feet in the High Island area of the Texas Gulf coast.

Here's how one operator saved more than $23,000 while drilling 9800 feet with a double gin pole rig on . . .

A Deep Slim Hole in the Gulf Coast Area of Texas

By MARVIN STONE, Petroleum Engineer,
Carnes W. Weaver Drilling Company, Houston

A SLIM HOLE well of more than 9800 feet has been drilled in the High Island area of the Texas Gulf Coast with a double gin pole mast and 2⅞-inch tubing. Total cost of this hole in which casing was not set reflected a savings of approximately $23,000 in drilling costs alone. An additional saving of approximately $5000 would have resulted had casing been set.

In August of 1954 the Carnes W. Weaver Drilling Company of Houston moved Rig 5 of Portable Well Service to Chambers County, Texas. Time was running out on a large lease and the operator needed to spud in within a few days. The wildcat location was vulnerable to Gulf storms and high tides. Rather than tie up a big rig for the rank wildcat which threatened to be both hazardous and costly, it was decided to move in a small rig and try a slim hole. It would have been impossible to set up a large rig in the time available. Neither the operator nor the contractor had any previous experience with slim hole drilling. The operator's objective was to see as deep a cross-section of the area as mechanical conditions would permit.

Small Rig Used. The rig selected was a trailer-mounted double gin pole 8¾ inch by 10¾ inch by 87 feet with a single drum drawworks and torque converter drive; a drilling range of 500 to 4500 feet with 4½-inch drill pipe. The rig was powered by a 185 horsepower engine. It was completely equipped for drilling operations—containing spinning and breakout catheads, hydromatic brake, a 12-inch rotary, and 6-foot substructure. Pumping equipment included:

One 7¼ inch by 10-inch mud pump powered by a 200-hp engine
One 5-inch by 10-inch mud pump powered by 145 hp engine
Two 2-inch centrifugal water pumps

Blowout preventors consisted of one 10¾-inch, 6000-pound WP, double preventor and one 10¾-inch gate valve—all above a double-studded spool with two choke lines.

Crews were composed of four men —1 driller and 3 helpers—with the exception of the day crew which had 4 helpers. Crewmen for the most part were young and experienced. No difficulty was encountered in crew cooperation. Cooperation of the crews and their previous drilling experience contributed most to the success of this operation.

Drilling conditions consisted of Gulf Coast Miocene sands and shales with no known abnormal conditions present. It was decided to dig a 6¼-inch hole as more varied bit types could be used and experimented with to speed up the drilling rate. Also, with the pumps available, a larger hole would be harder to keep clean and slower to drill. The 6¼-inch hole would not present too great a casing problem for a long string. However, as this was a dry hole, the long string problem did not arise. All personnel felt that if they could "drill the hole" they could case the hole.

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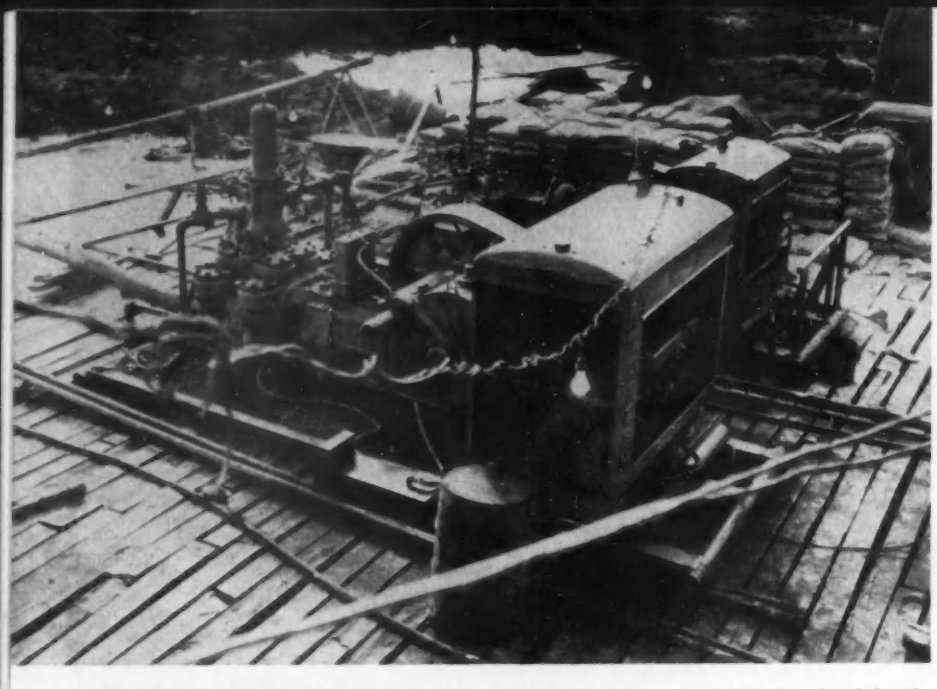


HYDRAULIC STUDIES showed that these mud pumps were capable of maintaining jet drilling conditions to 7000 feet. Higher pressures were needed below that level to maintain circulation rates.

Drill stem used was 2⅞-inch N-80 tubing with special tubing joints. Drill collars consisted of nine 3½-inch collars with total weight of 12,000 pounds. The drilling program as far as bits are concerned is outlined in Table 1.

It is to be noted from Table 1 that no drag bits were used. It is felt that possibly the use of four-way drag bits would have increased the drilling rate considerably, especially above 7000 feet.

Mud Program. The mud program probably was the deciding factor in the successful completion of the hole to its total depth. A good mud with excellent properties was maintained at all times. A 10 pound per gallon native-gel mud was carried to 5709 feet where the mud was broken over to lime base oil-emulsion with approximately 12.5 percent by volume oil in the mud. The oil-emulsion mud increased the penetration rate, reduced torque and drag, and acted as protection against salt water flows. At approximately 5900 feet the mud weight was raised from 10 ppg to 10.5, and at 6540 feet the weight was boosted to 11 ppg. Maximum mud weight was 12.3 ppg at 9600 feet. The cooperation of the operator in furnishing the best mud available was helpful. It should be remembered that the slim hole has a distinct advantage where mud costs are encountered because of the considerably lower volumes used. Table 2 shows the mud program.

Hydraulics. The hydraulics of the system were not checked until the operation was almost completed. Surprisingly enough, the hydraulics as far as bit nozzles used, were approximately the same as recommended by the bit engineer except for the last part of the hole. Actual nozzles and velocities and recommended nozzles

TABLE 1—Bit Record

Bit No.	Size	Type	Depth Out	Footage	Actual Drilling Time Hours	Weight 1000 Lbs.	Pump Pressure	SPM
1	15	A	1500	1500	..	..	....	..
2	9⅞	B	....	1500	..	..	....	..
3	6¼	C	2706	1206	28	6	600	65
4	6¼	C	3319	613	24	6	700	..
5	6¼	C	3598	239	24	6	700	..
6	6¼	C	4189	631	26	6	700	..
7	6¼	C	4451	262	24	6	700	..
8	6¼	C	4650	191	24	6	700	..
9	6¼	D	4883	233	28	6	700	..
10	6¼	D	5212	329	28	6	700	..
11	6¼	D	5470	258	30	6	700	..
12	6¼	C	5709	239	28	6	700	..
13	6¼	D	5803	94	20	6	1000	..
14	6¼	C	6061	258	30	8	1000	..
15	6¼	D	6482	421	24	8	1000	..
16	6¼	D	6572	90	20	10	....	..
17	6¼	D	6674	102	24	..	....	..
18	6¼	D	7009	335	28	..	....	..
19	6¼	D	7344	109	..	..	....	..
20	6¼	D	7453	223	24	10	....	..
21	6¼	D	7600	326	28	10	1000	..
22	6¼	D	7770	170	24	10	1000	..
23	6¼	D	7998	228	28	10	1000	..
24	6¼	D	8290	292	24	10	1000	..
25	6¼	D	8514	224	24	10	1000	..
26	6¼	D	8689	175	21	10	1000	..
27	6¼	D	8924	235	28	10	1000	..
28	6¼	D	9123	199	24	10	1000	..
29	6¼	D	9207	84	12	10	1000	..
30	6¼	D	9287	80	12	10	1000	..
31	6¼	D	9388	101	12	10	1000	..
32	6¼	D	9491	103	12	10	1000	..
33	6¼	D	9581	90	12	10	1000	..
34	6¼	D	9644	63	10	10	1000	..
35	6¼	D	9797	153	14	..	45	..
36	6¼	D	9803	6	..	..	....	..
37	6¼	D	....	....	..	..	....	..

Type A Bits—Soft unconsolidated formations.
Type B Bits—Soft unconsolidated jet type formation.
Type C Bits—Soft drilling jet type.
* Type D Bits—Designed for unconsolidated, broken and medium formations.

TABLE 2
Mud Program

Type Mud	Depth (Feet)	Mud Weight (Pounds per gallon)	Viscosity (Seconds)	Water Loss (cc's)
Native	2147	10.2	30	
	2881	10.2	30	48
	3327	10.3	33	
	3982	9.8	39	34
	4324	10.2	33	34
	4702	9.9	34	
	4883	9.7	34	14.0
	5151	10.0	38	
	5218	9.8	36	12.0
	5458	9.9	38	
	5610	10.0	38	
	5709	10.0	37	
Lime Base Oil Emul.	5803	10.0	54	
	5961	10.5	45	
	6160	10.5	55	
	6399	10.7	50	6.2
	6572	10.7	65	
	6583	10.6	65	
	6974	10.8	55	
	7038	10.9	54	
	7230	11.1	55	
	7294	11.0	55	7.0
	7453	11.1	55	
	7541	11.1	55	
	7663	11.1	55	
	8180	11.1	45	
	8307	11.1	48	
	8514	11.2	46	
	8608	11.4	52	
	8707	11.3	52	
	8911	11.3	52	
	8975	11.3	45	
	9123	11.3	56	
	9209	11.9	48	
	9287	12.1	50	4.2
	9377	12.0	55	
	9479	12.3	63	
	9566	12.3	60	
	9642	12.3	60	
	9796	12.1	55	
	9803	12.1	60	

are shown in Table 3. In the 7¼ x 10-inch pump, 6-inch liners were used to 7009 feet, where 5-inch liners were inserted.

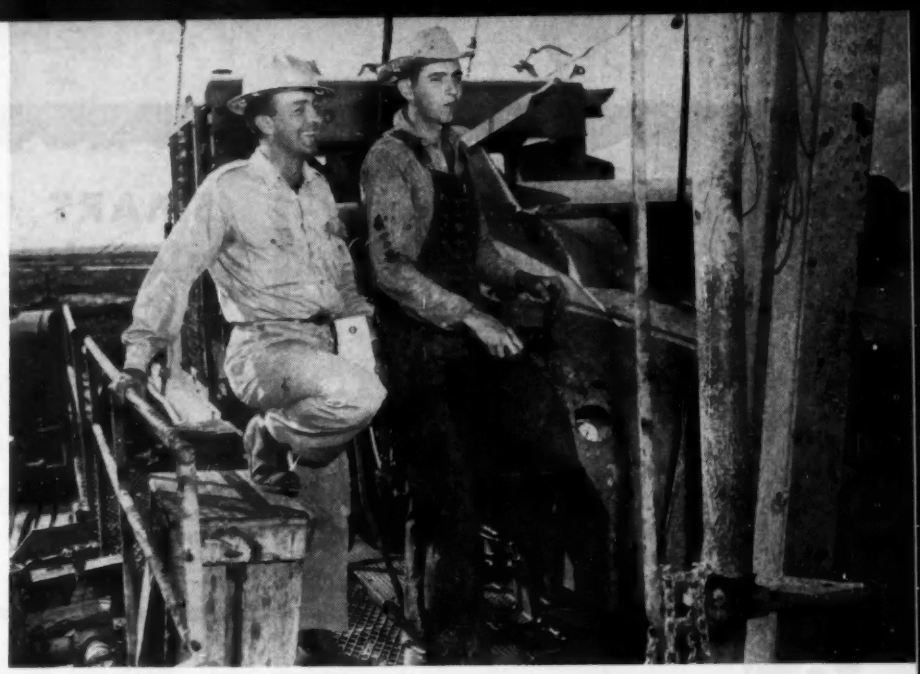
Actually about three conditions prevailed as the hole was drilled. Just out from under the surface casing, the pump speed was about 55 SPM. With the 6-inch liners, this gave a circulating pressure of about 600 pounds per square inch with 10 ppg mud. At this rate, the pressure loss through the surface equipment, 1000 feet of drill stem, drill collars, bit and around the drill collars and drill stem was 739 psi. Thus it is indicated that a higher circulating pressure should be carried. However, in practice, a balance between horsepower requirements and rig size must be met. More horsepower would mean a larger rig size. Experience gained in this hole indicates that if sufficient mud velocity and viscosity are kept to insure recovery of cuttings, a high circulating pressure is not necessary but is beneficial as to bit rate penetration.

The big drawbacks to the lower circulating pressures are the loss of bit efficiency and a tendency to ball up the bit. In the second case, as the footage approached 5700 feet it was necessary to slow down the pump. This was done to keep the circulating pressure at or below 1000 psi which is the pressure rating of the pump. Again it is noted that the pressure for the first 1000 feet of drill pipe is 653 psi. Theoretically, the pump should have been loaded fully at 3350 feet with 1000 psi working pressure, yet it was still in good operation at 7009 feet where the liners were changed to a 5-inch size.

In the third and final case, with the 5-inch liners, the following data were noted:

SPM—48 inches (Minimum)
Stroke length—10-inch
Liner size—5-inch
Circulation rate—140 gallons per minute
Number and size of bit nozzles—$3\frac{5}{16}$-inch
Annular velocity—117 feet per minute
Nozzle velocity—195 feet per sec.
Assume mud weight—10#/gal.
See Table 4 for pressure losses.

In summary, it appears that below 7000 feet, the pump was overloaded. However, circulating pressure was maintained at 1000 psi without difficulty. The oil emulsion mud helped a great deal to reduce friction and was an excellent choice for this type hole. Enough mud viscosity and velocity were maintained to clean the hole of cuttings at all times and no drilling difficulties were experienced. The oil emulsion mud also speeded up the drilling rate and helped to make up for lost bit efficiency with the lower circulating pressures.



ALL SMILES, Arthur Marvin Stone (left) and his driller watch the slim hole drilling progress of the rig that set an outstanding example of how to increase depth of small rigs.

Casing Program. Casing set in the hole consisted of 1090 feet of 10¾-inch. The first run of casing was unsuccessful. About 500 feet of casing had to be pulled and the hole was reamed before running casing again. The second casing run was successful and the casing was set and cemented without difficulty. It has been noted that perhaps 7-inch casing would have been better to use in this hole as surface casing. The smaller casing would have been easier to run and a smaller surface hole could have been drilled faster and perhaps with less difficulty.

TABLE 3

	COMPARISON OF PRACTICE				
	Actual Practice			Recommended	
Bit No.	Gallons per Minute	No. & Size Nozzles	Nozzle Velocity in Feet per Minute	No. & Size Nozzles	Nozzle Velocity in Feet per Minute
3	280	$3\frac{11}{32}$"	230	Same as	Actual
4	260	$3\frac{11}{32}$"	214	Same as	Actual
6	236	$3\frac{11}{32}$"	193	Same as	Actual
7	230	$3\frac{11}{32}$"	189	Same as	Actual
12	210	$3\frac{11}{32}$"	173	$3\frac{3}{8}$"	203
14	206	$3\frac{11}{32}$"	169	$3\frac{3}{8}$"	198

Also, it was felt that the smaller casing would have helped stabilize the 2⅞-inch drill stem.

However, it should be noted that with the 10¾-inch casing a larger rig could have been put on the location and the hole reamed allowing a protection string to be set or the hole could have been carried to a much greater depth if conditions warranted.

Casing the slim hole presents several problems. A quick look at the casing manual shows 4½-inch casing the maximum size possibility. Nine thousand feet of 7-inch has been run in an 8¾-inch hole, so 10,000 feet of 4½-inch should go in a 6¼-inch hole in much the same hole conditions and with even better mud. And, of course, 2⅜-inch tubing could be used in the 4½-inch casing. At 10,000 feet 11.6 pounds of N-80 casing (4½-inch) is needed for collapse. Roughly, 10,000 feet of 11-pound casing gives a weight of 110,000 pounds, which exceeds the limit we have imposed upon the little rig. Thus, it is obvious that the casing would have to be floated part of the way in and not worked once it hit bottom. (At a recent date the little rig has worked casing weighing 90,000 pounds.) It should be noted that the tight hole clearance could lead to mud loss with formation breakdown, bad cement jobs, stuck casing, and other troubles. But these same troubles have been encountered in normal holes with big rigs.

No fishing was done on this hole. The excellent properties of the mud

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was the major factor in eliminating this trouble. For example, the pipe was dropped off the kelly saver sub at 7230 feet while drilling on the bottom. A new saver sub was put on the kelly and the dropped string was screwed into 15 feet down. The dropped string picked up free and a trip was made to lay down a few joints of crooked drill stem. Normal drilling operations were resumed. Several articles have been written about smaller fishing tools and they will not be taken up here. (See WORLD OIL's Slim Hole Issue, May, 1954, Pages 117, 135, 154 and 168.)

The hole was logged electrically to the bottom without undue difficulty. No sidewall cores were taken but a sidewall gun is available for the slim hole. No wire line or conventional coring was attempted on this hole but 6¼-inch coring equipment is available.

Cost Comparison Breakdown

	Slim Hole Rig	Big Hole Rig (10,000-Ft. Rating) (All Costs Estimated)
Days to Total Depth.	51	30
Fuel (Butane).....	$2,570.16	$3,600.00
Water.....	400.00	400.00
Mud.....	8,393.38	12,000.00
Bits.....	4,631.00	5,000.00
Rig (Daywork).....	27,764.00	38,000.00
Trucking.....	1,846.71	5,000.00
Location.....	3,000.00 (Est.)	6,000.00
Miscellaneous.....	2,000.00 (Est.)	4,000.00
Total for Uncased Hole....	$50,605.25	$74,000.00
Estimated Casing Costs.....	$14,000.00 (4½" N-80)	$19,000.00 (5½" N-80) $23,520.00 (7" N-80)

The future of the slim hole is bright. Slim holes and shallow wells seem to go together. Some operators have drilled shallow holes with 2⅞-inch tubing and cemented it in place for a long string. (See WORLD OIL, June, 1954, Page 104). As offshore drilling and wildcatting increases, the slim hole seems to be the answer. The slim hole is faster. It can be drilled cheaper and with less and smaller equipment. Completion costs are lower on slim holes. Better equipment is being made to aid the slim hole operation. Tools are stronger, lighter, and smaller.

Bit research is continuing even though bit bearing performance in the smaller sizes still is subject to improvement. Drilling rigs, barges and platforms are being revised. All of the research, development and revision points to a smaller, faster, and less expensive hole.

Brightest prospect for slim hole seems to be offshore. Not only is the cost of exploratory holes lower to the operator, but the slim hole will allow small drilling contractors to furnish drilling equipment and as a result the cost to the operator will be cut by competition. —**The End**

TABLE 4—Slim Hole Hydraulic Data*

Carnes W. Weaver Drilling Company
Chambers County, Texas

	Assumed Case I	Proposed Hydraulic Program to 3350 Feet	Proposed Hydraulic Program From 3350 Feet to 7000 Feet
SURFACE EQUIPMENT			
Pump:			
Piston Size	5"	5"	5"
Length of Stroke	10"	10"	10"
Strokes per Minute	55 (Minimum)	48 (Minimum)	48 (Minimum)
Standpipe I.D. x Length	3" I.D. x 40 Foot	3" I.D. x 40 Foot	3" I.D. x 40 Foot
Hose I.D. x Length	2" I.D. x 45 Foot	2" I.D. x 45 Foot	2" I.D. x 45 Foot
Swivel I.D. x Length	2" I.D. x 4 Foot	2" I.D. x 4 Foot	2" I.D. x 4 Foot
Kelley I.D. x Length	2¼" I.D. x 40 Foot	2¼" I.D. x 40 Foot	2¼" I.D. x 40 Foot
DRILLING EQUIPMENT			
Size Hole	6¼"	6¼"	6¼"
Drill Stem: Size Wt	2⅞" N-80 Tubing 6.50 lb.	2⅞" N-80 Tubing 6.50 lb.	2⅞" N-80 Tubing 6.50 lb.
Type Tool Joints	OMSCO—Thread IF	OMSCO—Thread IF	OMSCO—Thread IF
Tool Joint O.D. I.D.	2 7/16" I.D.	2 7/16" I.D.	2 7/16" I.D.
Drill Collars: Total Length	270 Feet	270 Feet	270 Feet
O.D. I.D.	O.D. 3½" x I.D. 2"	O.D. 3½" x I.D. 2"	O.D. 3½" x I.D. 2"
Mud Type	12.5% Oil Base at 5700 Feet	12.5% Oil Base at 5700 Feet	12.5% Oil Base at 5700 Feet
Mud Weight Lbs. per Fallon	Assume 10 lb. per Gallon	Assume 10 lb. per Gallon	Assume 10 lb. per Gallon
(1) Circulation Rate: In Gallons per Minute	(Minimum) 230	(Minimum) 200	(Minimum) 140
(2) Size of Liners	6"	6"	5"
(3) Number and Size of Bit Nozzles	3—11/32"	3—3/16"	3—4/16"
PRESSURE LOSSES FOR 1000 FT. OF DRILL STEM PLUS COLLARS AND BIT			
(4) Through Surface Equipment	45 Psi.	35 Psi.	18 Psi.
(5) Through 1000 Ft. of Drill Stem	197 Psi.	152 Psi.	78 Psi.
(6) Through Drill Collar Bore	141 Psi.	108 Psi.	57 Psi.
(7) Through Bit Nozzles	323 Psi.	335 Psi.	341 Psi.
(8) Around Drill Collars	13 Psi.	8 Psi.	6 Psi.
(9) Around 1000 Ft. of Drill Stem	20 Psi.	15 Psi.	8 Psi.
(10) Total Pressure Loss—Items (4) Through (9)	739 Psi.	653 Psi.	508 Psi.
(11) Total Pressure Loss Corrected for Mud Weight: (Line 10) / 10 x Mud Weight = / 10 x /	10/10 x 739 = 739 Psi.	10/10 x 653 = 653 Psi.	10/10 x 508 = 508 Psi.
(12) Depth: 1000 Feet of Drill Stem Plus Feet Drill Collars =	+ 270 Ft. = 1270 Ft.	+ 270 Ft. = 1270 Ft.	+ 270 Ft. = 1270 Ft.
ADDITIONAL PIPE THAT CAN BE ADDED BEFORE REACHING RATED PUMP CAPACITY			
(13) Pressure Rating of Pump	(Actually Usage) 1000 Psi.	(Actually Usage) 1000 Psi.	(Actually Usage) 1000 Psi.
(14) Pressure Loss for First 1000 Ft. of Drill Stem Plus Collars and Bit (Same as Line (11) Above)	739 Psi.	653 Psi.	508 Psi.
(15) Pressure Remaining for Addition of More Pipe Subtract Line (14) from Line (13)	261 Psi.	347 Psi.	492 Psi.
(16) Pressure Loss for Each Additional 1000 Feet of Drill Stem Line (5) Plus Line (9) = Plus =	197 + 20 = 217 Psi.	152 + 15 = 167 Psi.	78 + 8 = 86 Psi.
(17) Line (16) Corrected for Mud Weight: Line (16) / 10 x Mud Weight = / 10 x / =	10/10 x 217 = 217 Psi.	10/10 x 167 = 167 Psi.	10/10 x 86 = 86 Psi.
(18) Footage That Can be Added = Line (15) / Line (17) x 1000 = x 1000 =	261/217 x 1000 = 1200 Ft.	347/167 x 1000 = 2080 Ft.	492/86 x 1000 = 5730 Ft.
(19) Depth at Which Pump Will be Fully Loaded: Line (12) Plus Line (18) = + =	1200 + 1270 = 2470 Ft.	2080 + 1270 = 3350 Ft.	1270 + 5730 = 7000* Ft.
(20) Input Horsepower Required at This Depth: IHP/Psi. x Psi. =	.158 IHP/Psi. x 1000 = 158 IHP	.137 IHP/Psi. x 1000 = 137 IHP	.096 IHP/Psi. x 1000 = 96 IHP
Annular Velocity in Feet per Minute	200 Ft./Min.	175 Ft./Min.	117 Ft./Min.
Nozzle Velocity	189 Ft./Second	193 Ft./Second	195 Ft./Second

*Because of the Oil in the Mud, the Depth will be more than 7000 Feet Before 1000 psi. will be reached.

Work Sheet—Hughes Tool Company.

How R/A Well Logging Is Used In West Texas

Value of this technique is shown where measure checks, porosity determination, and absolute definition of formations as tops and bottoms are critical.

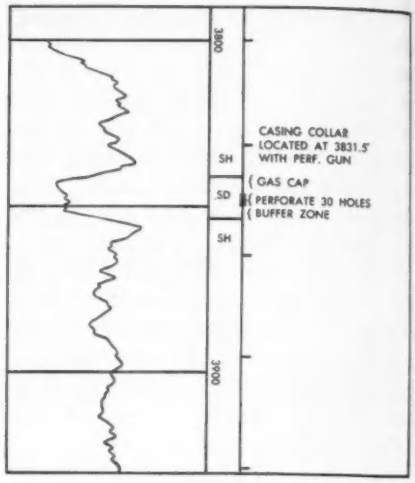


FIGURE 1

By A. J. KERR, Lane-Wells Company, Wichita Falls, Texas

DUE TO THE many producing formations and varied completion techniques in West Central Texas, no cure-all has been developed yet that is applicable to the logging needs for all wells. The purpose of this article is to show the value of radio-active well logging in the completion of many wells where measure checks, porosity determination, and absolute definition of formations as tops and bottoms are found to be critical.

Figure 1 shows an example where accurate downhole measurements played a vital part in the successful completion in the upper Gardner sand. Drill stem test of this zone indicated a high gas-oil ratio, making it necessary to set casing through the pay in order to insure control. The critical problem was to be able to perforate with extreme accuracy in order to stay out of the gas cap, yet at the same time leaving a three-foot buffer zone at the bottom of the pay in case it was necessary to fracture the well at a later date.

The well was perforated with 30 holes from 3847 feet to 3951 feet and swabbed in, making well above its allowable with an acceptable gas-oil ratio. This identical problem has been encountered and solved many times by this same process which is a system of collar location at the same instant the radioactivity log is run, thereby making it possible to return to any given point down the hole by referring to collars as a bench mark.

Porosity determination. The neutron curve, because of its ability to define porosity changes, may be calibrated in terms of porosity. Such calibration is applicable only in zones which are low or free of contaminating material such as shale, silt, etc., as indicated by the gamma ray curve. To arrive at this calibration, one well in a given field must be cored and logged as shown in Figure 2. The example is a limestone formation locally called the Odom pay in the Fort Chadbourne field in Runnels County. The radioactive log and the core analysis are plotted on the same scale as shown by Figure 2. At each segment of the analyzed core, the distance from neutron zero reference (or some established uniform reference), to the point of neutron deflection is measured in inches. The inches of deflection at a particular point are then plotted on semi-log graph paper against the porosity value at that point. Figure 3 shows an agreement

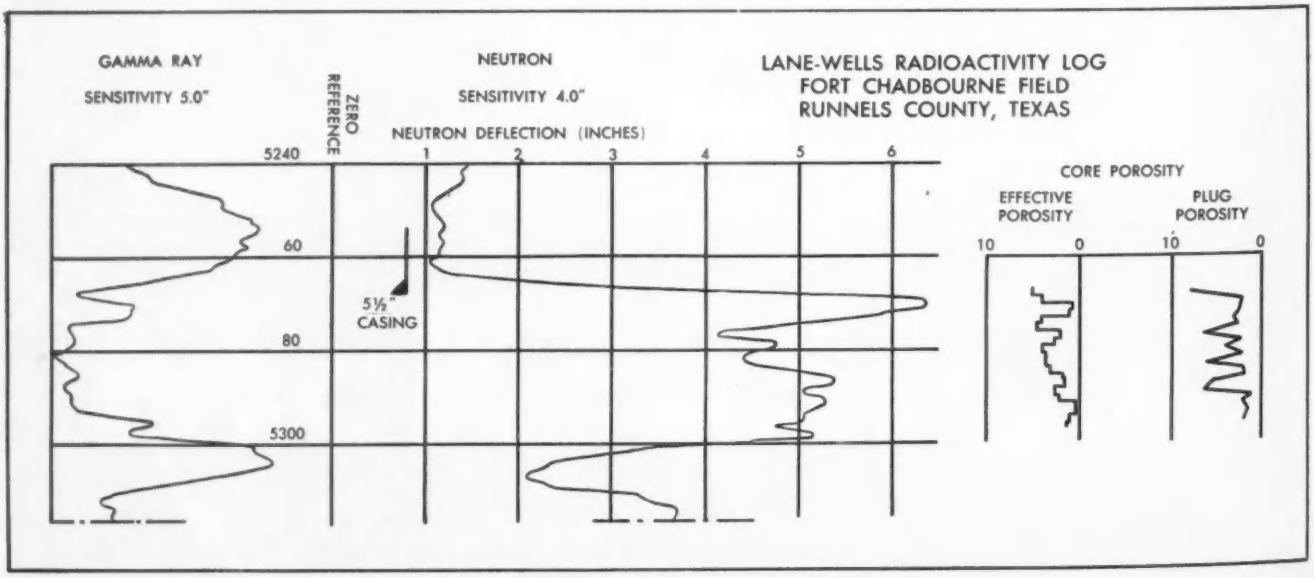
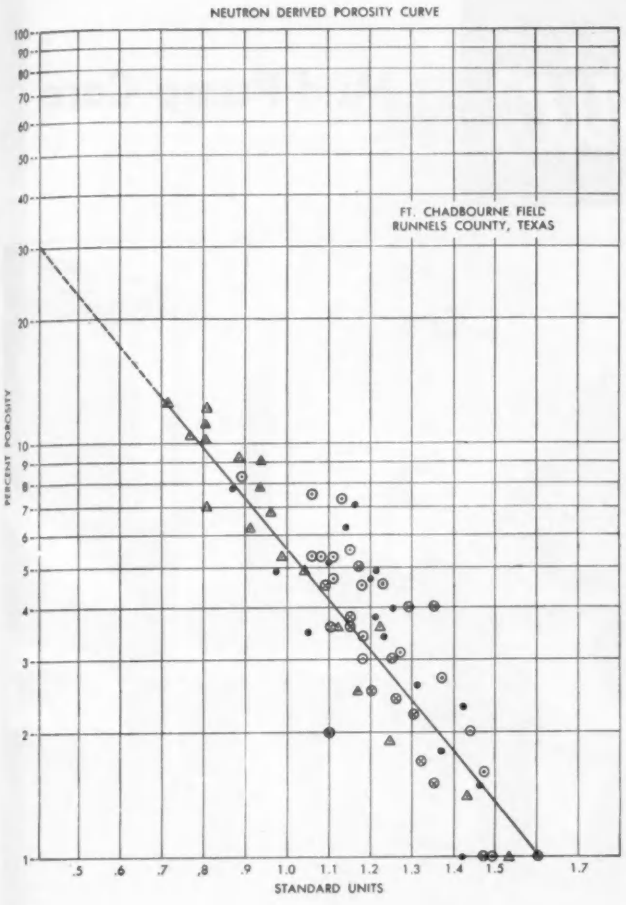


FIGURE 2



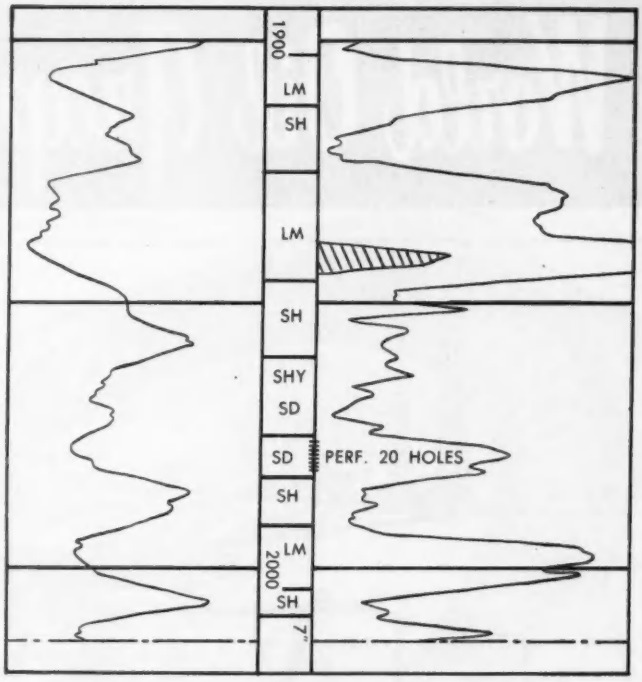


FIGURE 4 (above)

FIGURE 3 (left)

of four wells in the Fort Chadbourne field with an average line drawn through the plotted points.

Since there are different sensitivities, the neutron deflection is divided by the sensitivity of the log. The results obtained are standard units. This enables all wells to be plotted in the same units. In these four wells the neutron derived porosity and plug core porosity checked within 1 percent. On an uncored well in a field where a neutron derived porosity curve is set up, the log may be read directly in inches and the corresponding porosity read from the curve. Care must be observed that the same borehole conditions, curve sensitivity, etc., are obtained. To facilitate the reading of the log, a scale may be easily constructed as shown, whereby porosities may be read directly from the log. This makes it possible to determine porosities in a given field by running a radioactive log on each well. With the porosity data obtained by this method, barrels of oil in place can be computed, thereby offering reservoir evaluation. This system offers porosity information without the expense of an extensive coring program. If a limestone is not of sufficient thickness for porosity determination, then it lends itself to a measure discrepancy, thereby revealing the acute need of a measure check.

Radioactive logging in conjunction with fracturing. In the past, when radioactive logs were run for the purpose of trying to determine why a fracturing job had failed to produce the desired results, it was discovered that a sand-shale contact had been exposed. With this information brought to light, it was reasonable to assume that the fracturing material had followed the sand-shale contact instead of entering the sand; consequently realizing little or no value from the particular operation.

With this thought in mind, experience in this type of work has shown that it is advisable to set casing through the zone to be treated and perforate so that a minimum of 1 to 2 feet of zone can be left on both the top and bottom of the formation to act as a buffer.

Figure 4 illustrates the effect of such action. The over-all zone in this example extends from 1975 feet to 1983 feet in the Tannehill sand. This well was perforated with 20 holes from 1976 feet to 1981 feet for a fracture job. Well was potentialed for 170 barrels of oil per day. Excellent results have been obtained from numerous other wells confronted with the same problem where a very slight measure discrepancy would have exposed a sand-shale contact had it not been for the use of the radioactive log.

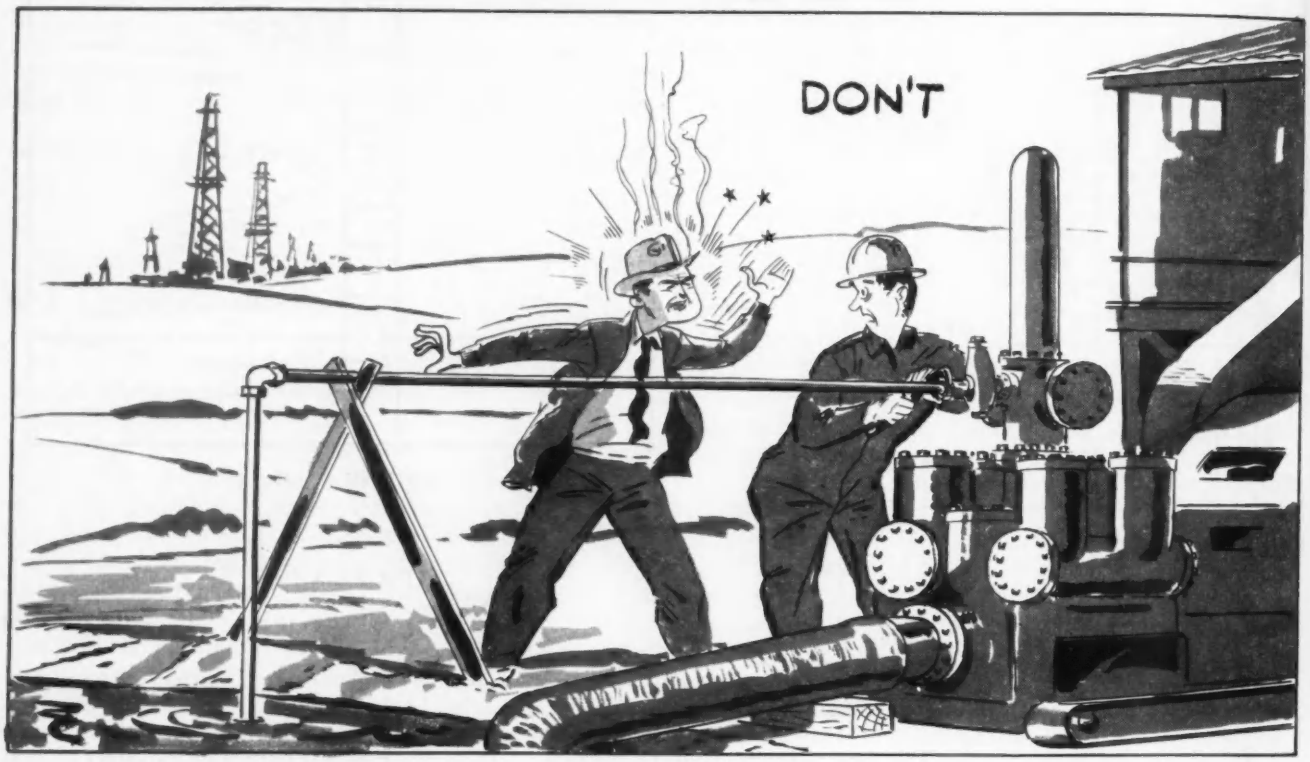
As has been stated previously, no system is in existance that will provide all the answers desirable, or solve all the problems encountered. Where measure discrepancies, porosity determination, and fracturing operations are concerned, a radio-active log may well offer the information necessary for successful completion.

Although examples cited in this article refer to a limited area, application of the technique will prove valuable in wells in other oil-producing areas where similar conditions obtain.

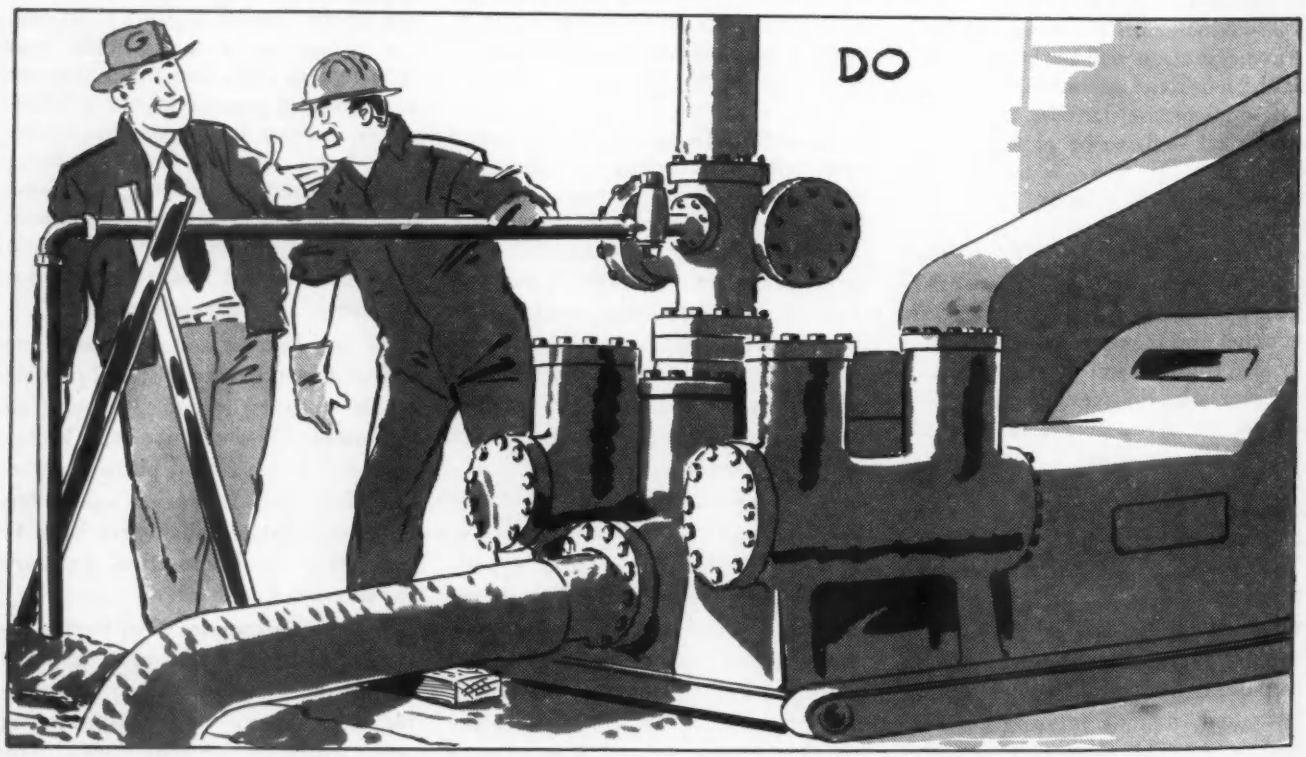
—The End

World Oil Graphics

Mud Pump Care



Avoid long relief valve discharge line. Ice plugs may form in winter; in summer, dried mud may block line.



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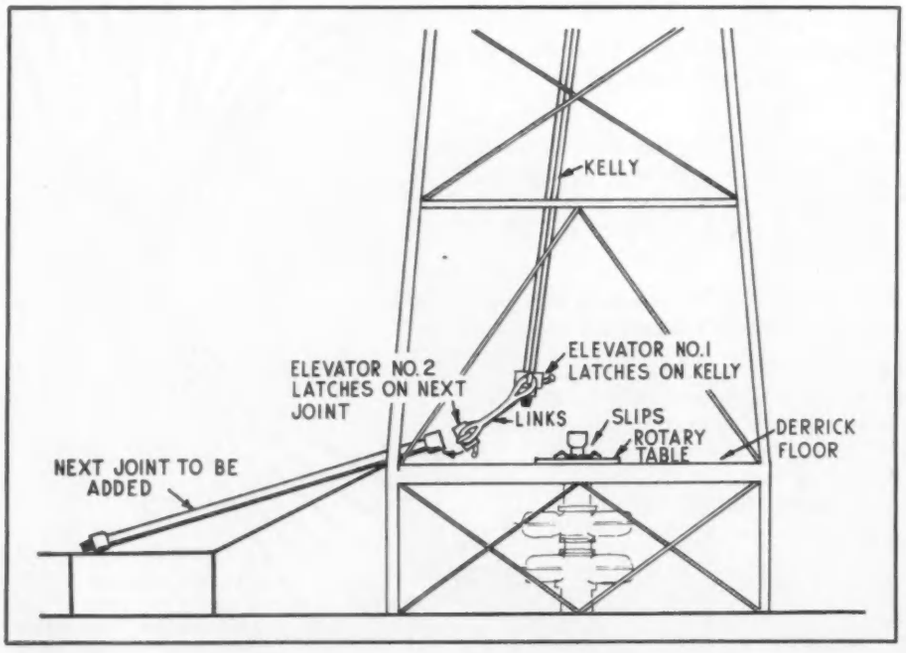
Mount Generator Plant on Twin Skids

The light plant is one of the most necessary items around a drilling rig because if the power if off, the entire drilling operation comes to a standstill. One contractor uses two complete electric sets to furnish auxiliary power for his rig. One set is approximately twice the capacity of the other, yet the smaller one is capable of keeping up the power requirements in case of emergency.

By using a large set and a smaller set mounted on the same set of skids, the power requirements may be met on a more efficient scale. While rigging up and drilling the hole for the surface pipe when the requirements are small, the small set can be used which decreases the fuel requirements and causes wear and tear on the least expensive set.

When the hole is half way down and the power requirements are higher, the small unit is removed from service and the larger unit started up to give more power for the shale shaker, circulating pumps and other uses of current around the rig besides lighting. The smaller unit is then kept in readiness of emergencies. Of course if unusual power demands are required, both sets can be run in tandem to furnish sufficient power for all requirements.



Flying Rathole Aids Connections

Many drilling contractors have found that a flying rathole is an especially fine tool when the surface is too hard to drill. Although some contractors prefer to hang the kelly out of the way during this operation, some find that by latching one elevator on the kelly faster connections are possible.

Use two links to joint elevator number 1 (which latches to the kelly) and elevator number 2 (which latches on the next joint to be added). Pull the next joint into the derrick high enough to permit addition of the new joint.

Finally the kelly is added and drilling is ready to begin.

Make Portable Workbench From Pipe and Wood Plank

One drilling contractor has fashioned a sawhorse with pipe legs into a sturdy bench which can be used around drilling rig. Two legs shaped like a block letter "A" form the framework for the bench. By passing a two inch oak plank (or similar rig timber) between the two horizontal bars enclosing the upper portion of the "A" a substantial workbench can be assembled. A chain tong pipe vise

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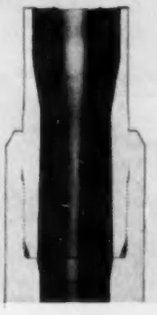

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has been bolted to the outer extremity of the wooden plank.

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The electric horn shown above the water bottle can be used for signaling various crewmen when they are needed at the doghouse or on various positions on the rig.

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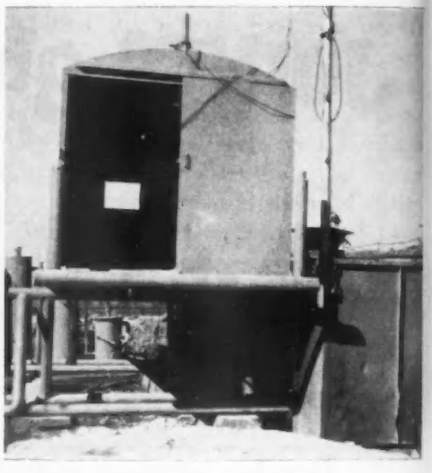

Use Drill Pipe to Raise Steel Mud Storage House

One West Texas drilling contractor has fabricated a steel substructure frame with legs of old drill pipe. The legs support a steel doghouse at a convenient height for workmen to maintain good conditioned muds. Note the sliding steel door at the end of the building—this permits rapid unloading of sacked mud direct from the bed of the truck into the storage area.

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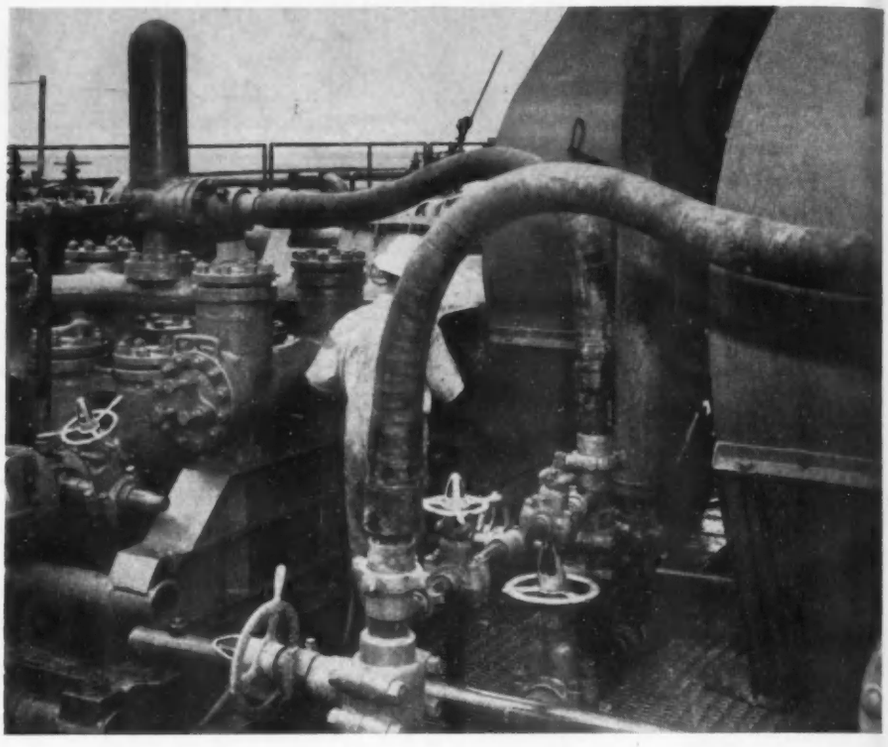
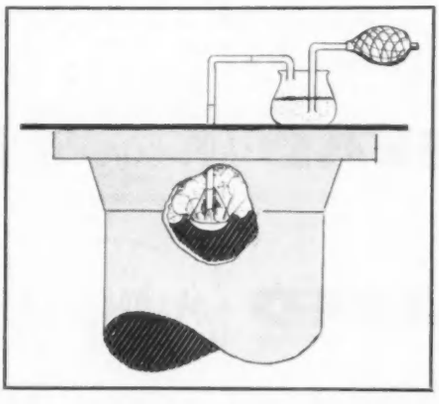
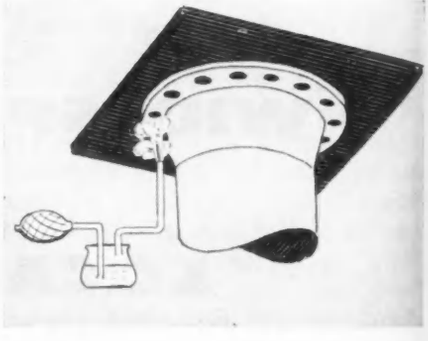


Lay Steel Walkway Around Mud Pumps

One West Texas drilling contractor has found that maintenance and close supervision of mud pumps will get closer attention from crewmen if steel grating is placed around the pump piping so the crewmen will not have to walk in the mud. This has a psychological effect on the crewmen and has paid big dividends since rig personnel do not mind checking equipment when a walkway is provided.





Atomizer Makes Gasket Pattern

An atomizer loaded with chalk dust or talcum powder can be used to make an accurate pattern for cutting gaskets for flanges.

The common practice of hammering a gasket out of material laid over the flange results in inferior gaskets and sometimes in damage to the serrated face of the flange. On the other hand, tracing the pattern with pencil onto the gasket material is difficult and often inaccurate.

Here is an inexpensive method of obtaining the pattern. Simply outfit a dry type atomizer as shown in the illustration. Place the gasket material on top of the flange, and spray the inside of the gasket first, using the deflector as shown in the illustration. After the outside and inside have been marked, cut the gasket from the blank material, using a punch to cut the bolt holes.

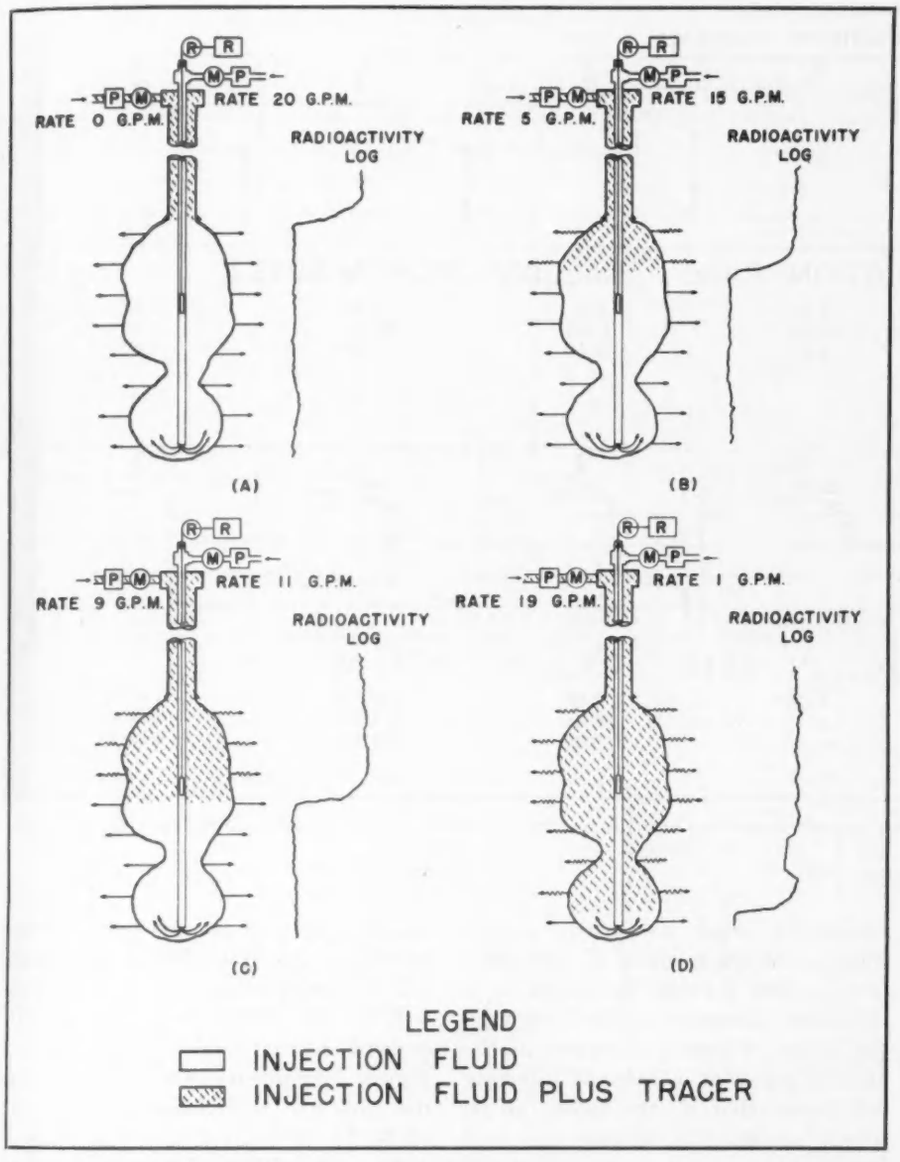


Fig. 1—Procedures in making water injectivity profile surveys by The Texas Company's new method are shown schematically.

New Method Simplifies Water Injectivity Profile Logging

Technique is not affected by pressures, volumes injected, temperature or bore diameter.

By E. F. EGAN, Producing Department, The Texas Company, Bellaire, Texas and **A. S. McKAY,** Producing Department, The Texas Company, New Orleans

A SLIGHTLY radioactive solution is used in a new technique to accurately determine injectivity profiles of water input wells. It meets the industry's need for a quantitative, universal, low-cost method of determining the location and volume distribution of water injected into a formation. The idea has been proven by a considerable body of field experience to be both quantitative and generally acceptable.

It requires that tubing be run in the injection well below the lowest depth to be surveyed. A slightly radioactive solution is used to identify either one of the two streams being pumped into the input well; one of the streams being fed into the tubing, the other fed into the annulus or casing. Figure 1 is a schematic illustration of this method where the stream being fed into the annulus contains a radioactive tracer. In Figure 1-B, all of the water being fed into the annulus leaves the well bore above the depth where the radioactive water meets the non-radioactive water which has come down the tubing. There is very little mixing between the two streams with the result that a sharp interface is set up in the annulus.

Depth in the well bore where the two streams meet, i.e., the position of the interface is established by running a small gamma ray logging sonde in the tubing. Response of this tool changes sharply as it moves up through the interface.

Rates of injection of the two streams can be controlled and metered at the surface and are adjusted so that the sum of the two rates is kept constant. In this way, any possible variations in the shape of the injectivity profile which could be caused by changes in the total injection rate are eliminated. If the flow rate of one stream is decreased, a certain amount, say "X" gallons per minute, and the flow rate of the other stream is increased exactly this same "X" gallons per minute between successive determinations of the position of the interface. It is known that "X" gallons per minute is being injected in the depth interval between the two interface positions.

The vertical distance between successive positions of the interface depends on the size of "X" and also on the formation permeability in this particular interval. If the permeability is low, the interface may move a considerable distance. At the other extreme, when a large percentage of the water is escaping around a casing shoe or through a formation fracture, the interface may remain stationary.

If the size of "X" is kept fixed at, say, 10 percent of the total injection

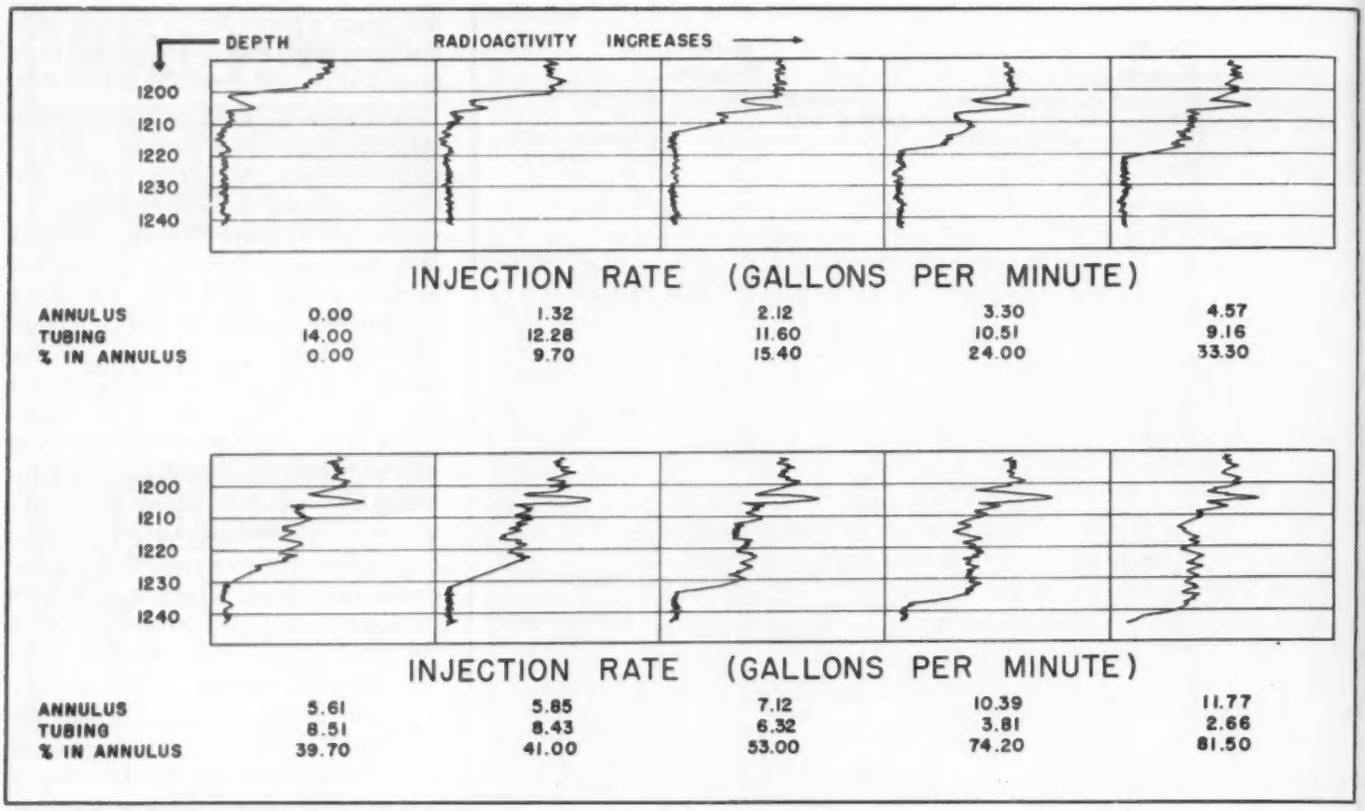


Fig. 2—Composite injectivity logs of typical survey, demonstrating how the interface between radioactive and non-radioactive water can be followed.

rate, a complete survey would show the water leaving the bore hole in ten intervals. The arbitrarily chosen size of "X" determines the resolution obtained in the survey.

Survey procedures. It is standard practice to obtain a natural gamma log prior to the injection of the radioactive isotope. The natural gamma log can be correlated with the original electric log and core records. In addition, it provides a reference background which sometimes can be used to locate a zone of loss behind casing when water is flowing past the casing shoe.

The injectivity survey is conducted by pumping non-radioactive water through the tubing and radioactive water through the annulus in a succession of steps in which the ratios of the pumping rates of the radioactive and non-radioactive waters are varied in increments ranging from a minor proportion of radioactive water to a major proportion of that stream. Simultaneously, injection rate of the non-radioactive stream is varied such that the total injection rate of the two streams is kept at a constant value.

At each pumping rate an interface is formed in the annulus between the radioactive and non-radioactive waters, and the position of this interface is then located by means of a radiation detector lowered through the tubing. Figure 1-A represents the highest point at which an interface will form, that is, the depth above which no fluid is leaving the well bore.

As the ratio of radioactive water to non-radioactive water is increased, the interface will move down, exposing more of the permeable zone to injection of radioactive water. The ratio of radioactive water to non-radioactive water is changed by increments and the location of the interface found with the gamma ray detector. Figure 1-B illustrates this movement of the interface by changing the injection rates to 5 gallons per minute of radioactive water in the annulus and 15 GPM of non-radioactive water in the tubing. The zone located between the interfaces shown in Figures 1-A and 1-B, is taking water at the rate of 5 GPM or 25 percent of the total injected water.

Figure 1-C illustrates further movement of the interface by changing the injection rates to 9 GPM or radioactive water in the casing and 11 GPM of non-radioactive water in the tubing. The zone located between the interfaces shown in Figures 1-B and 1-C is taking water at the rate of 4 GPM (9 GPM - 5 GPM), or 20 percent of the total injected water. Figure 1-D illustrates the position of the interface with injection rates of 19 GPM radioactive water in the annulus and 1 GPM of non-radioactive water in the tubing.

Advantages of method. The present technique is completely insensitive to factors which often destroy the effectiveness of some injectivity survey methods. For example, variations in bore hole diameter which often are encountered after an open hole has been shot with high explosive present no difficulties. In addition, there is, in practice, no lower limit to the bore hole flow velocities below which the survey is unreliable. In fact, it is now possible to compare injectivity profiles taken at high and low rates of injection with confidence that any differences in injectivity profiles are actually due to differences in rates of injection rather than variations in the accuracy of the survey. This method is insensitive to temperature and has no pressure limitations.

Chemical compositions of the two streams of injection water are identi-

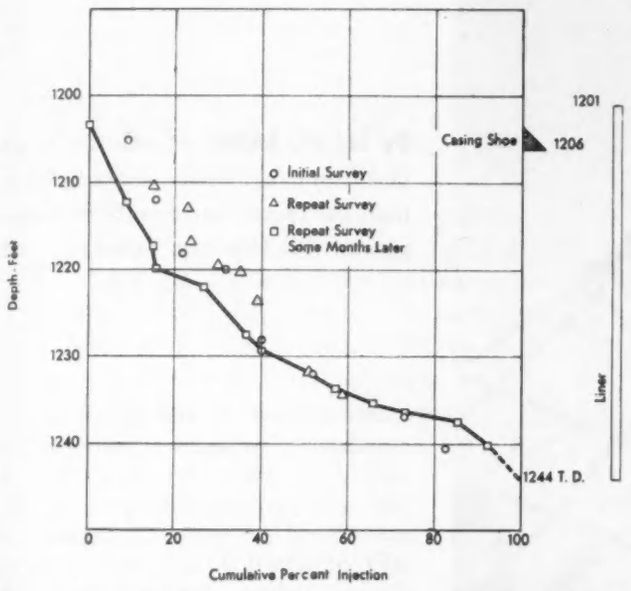


Fig. 3—Reproducibility of injectivity logs is shown on this curve which summarizes three separate surveys run at different times.

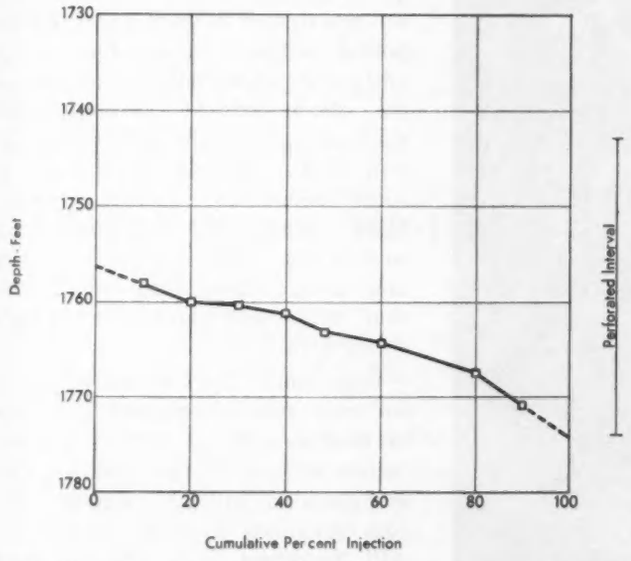


Fig. 4—Resulting curve of well in which one zone took most of the injected water.

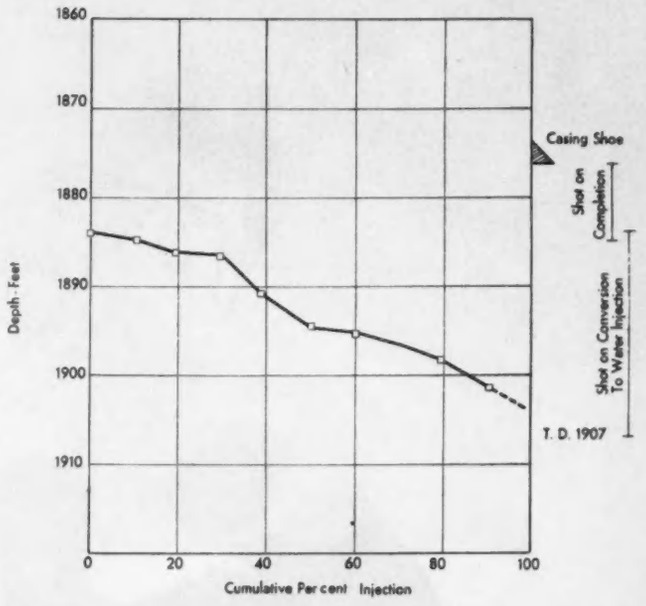


Fig. 5—Formations in this well are taking water fairly uniformly, indicating a successful shooting job.

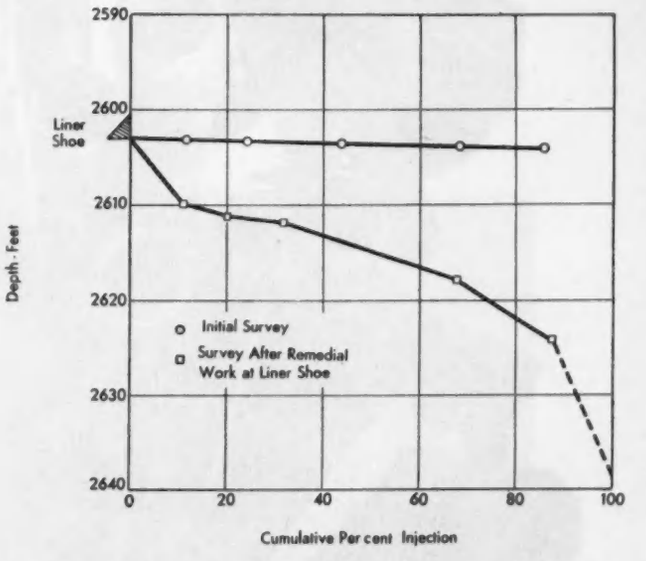


Fig. 6—Two surveys on the same well. The horizontal line indicates that all injected water is going behind the casing. A workover corrected the situation as indicated by the injectivity profile taken later.

cal, except for the minute amount of radioactive tracer. This is an important point in that the apparent permeabilities of some formations depend on the salinity of the injected water.

Hookup is simple. The interface detecting tool is run in the tubing. If it is possible to unseat the packer and lower the tubing to the bottom of the zone of interest, it is not necessary to pull the tubing. No elaborate well preparation or equipment is required and the survey can usually be conducted in a few hours with little interruption in the injection process. In the course of one survey, it is possible to obtain an injectivity profile of the injection zone or zones, check the casing for leaks, check all cement jobs, and evaluate any remedial work which has previously been performed on the well.

Since the well is not permanently contaminated by radioactivity, it is possible to run as many injectivity profiles as one may need in the course of remedial work or to repeat any point that is uncertain. Iodine-131 in the form of sodium iodide is a suitable radioactive tracer. It is readily available and reasonably priced.

Field cases. Below are examples of various types of injectivity profiles which have been obtained in several different fields. Fig. 2 shows a series of individual logs obtained on a typical water injection well. This well, with ten different ratios of radioactive to non-radioactive water pumping rates, demonstrates the ease with which the interface may be determined. The well takes approximately 500 barrels of water per day. It has been shot and is gravel packed behind a four-inch slotted liner, whose top is set at 1200 feet.

Position of the interface is easily determined from the sharp break on each log, and moves down in irregular steps from one log to the next in the course of the survey. Of course, in normal practice, it is not necessary to log the total length of the injection

Continued on Page 158

OIL WELL CASING, representing the largest tonnage item of all oil country tubular goods, had some specification changes made during 1954 by the API pipe committee.

API Tubular Goods Standards Reviewed

Because existing API tubular goods standards and recent modifications are vitally important to the oil industry, and because some may not be fully aware of these standards, WORLD OIL is publishing this review which was presented to the 34th Annual API meeting held in Chicago, November 7-11, 1954.

By H. W. LADD, Stanolind Oil and Gas Company, Tulsa National Chairman, API Committee on Standardization of Oil Country Tubular Goods.

FOR THE FIRST time, a provision for mandatory hydrostatic testing at the mill of all grad N-80 casing and tubing to 80 percent of its specified minimum yield strength was included in API Standard 5A, "Specification for Casing, Tubing, and Drill Pipe" published in its 19th edition, March, 1954. The API Mellon Institute fellowship was reactivated to study a thread compound containing a soap-base vehicle and costing about one-fifth as much as the silicone-vehicle compound officially adopted by the API. Other current studies include development of specifications for: casing of grades higher than N-80; high-strength oil well tubing; integral joints for tubing and casing; tubing with walls heavier than the present standards; and high-strength drill pipe.

Suggestions for reducing present roll sizes were investigated, but it was decided to take no action. Improvements and additions listed here are incorporated in API Standard 5L, "Specifications for Line Pipe," and API Standard 5LX, "Specifications for High-Test Line Pipe," both to be re-issued this year. An API Subcommittee on Plastic Pipe was recently appointed to develop standards for plastic pipe for oil field application.

Membership in the API Committee on Standardization of Oil Country Tubular Goods is selected to provide adequate national representation for both users and manufacturers. A unique and very much worthwhile feature in the structure of these committees (and this is particularly applicable to our so-called "pipe committees") is the existence of a subcommittee of user-engineers and one of manufacturers who meet separately to resolve for themselves the subjects under consideration, and then meet together to take joint action for subsequent letter ballot of the entire committee membership. This system of

This is trouble...

This liner (unretouched photo) was taken from a pump operating in a Mid-Continent oil field. Note how the effect of impact and corrosion has caused splitting and channeling. Cause of this breakdown might well be the operator's choice of a pump liner not designed to meet the conditions existing in the well.

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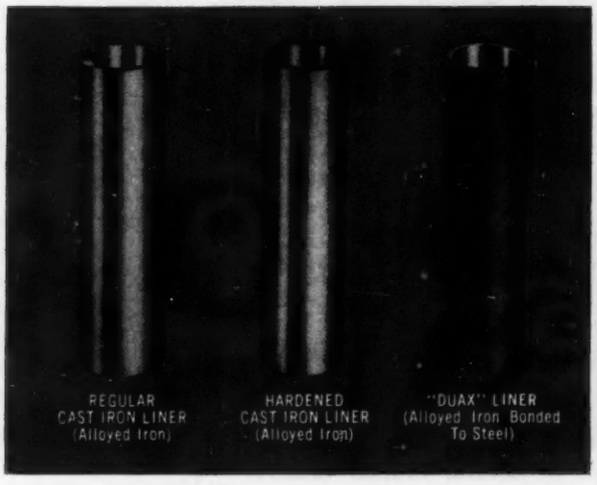

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first working out the consensus of each group's interest in its own committee saves much time and futile discussion which might otherwise occur.

It does not mean that peace and harmony are always achieved thereby. As all are members of the human race and users of the English language, there are many differences of opinion and interpretations, both individually and collectively. Demands are sometimes made which cannot be agreed upon immediately, and time must bring the solution.

The committee is criticized more for lack of speed in action than anything else, but specification development is necessarily a slow process. There is no specification-making body more aware of the need for keeping its standards in tune with the ever-changing requirements of the industry it serves than this API pipe committee. It has been found that hurrying matters unduly invites serious errors and mistaken policies. Standards must be the result of experience. A standard specification has been described as "a good definition of a successful product," and this seems reasonably applicable.

API Standard 5A, "Specifications for Casing, Tubing, and Drill Pipe" (oil country tubular goods) was published last March in its nineteenth edition. It includes for the first time the provision for mandatory hydrostatic testing at the mill of all grade N-80 casing and tubing to 80 percent of its specified minimum yield strength. It took the committee about eight years to accomplish this. The mills had to be sold on the oil industry's need for such testing to the extent that the expenditure of several million dollars for high-pressure testing equipment would be justifiable. It is quite generally agreed now that this high test goes a long way toward assuring the quality of this product.

Thread compound development. The API thread compound development project with the Mellon Institute produced the API high-pressure thread compound. When the research work was discontinued, there were some uncompleted tests being conducted on cheaper compounds containing a soap-base vehicle instead of the silicone vehicle used in the first-mentioned compound. Because one pipe manufacturer has adopted the use of this alternate compound, which is found to be of high quality, the American Petroleum Institute has reactivated the Mellon Institute fellowship to complete those tests.

Results will soon be available and field tests will probably be made thereafter. If the alternate compound proves itself suitable, it also may be adopted by the Institute, possibly for use under circumstances where maximum joint-leakage protection is not required. Its cost is about one-fifth that of the silicone-base compound. As the importance of using an adequate thread compound on API joints becomes more generally recognized, the use of compounds made under the formulas developed by the Institute is steadily increasing.

Specifications in process. Specification requirements for a casing grade higher than N-80 have not yet been determined. Differences in manufacturing processes seem to provide the main difficulties in establishing a uniform specification. The mills have yet to agree on the physical properties for the specification, mainly as to whether the minimum yield strength shall be 105,000 pounds per square inch or 110,000 psi. Two mills are now marketing 110,000 psi yield strength casing. A smaller quantity of 105,000 psi casing is being produced. But there is not enough high strength casing being made available to satisfy industry demands. Other mills are installing or planning to install the equipment necessary to make such casing, but any considerable increase in production seems a long way off.

Possibilities of developing standard specifications for high strength oil well tubing is even more complicated. Two companies with oil country mills only make 105,000-pound yield strength alloy steel oil well tubing and show it in their price lists. Other companies with oil country and specialty mills and companies with specialty mills only furnish such alloy tubing from the specialty mills with chemical and physical properties as may be agreed upon with the purchaser. Apparently, user demand for high strength oil well tubing is divided into two general classifications: (1) those who want it made of an alloy steel which will produce physical properties adequate to resist high tensil and internal stresses; and (2) those who desire it made of an alloy steel which will inhibit corrosion in addition to providing high strength.

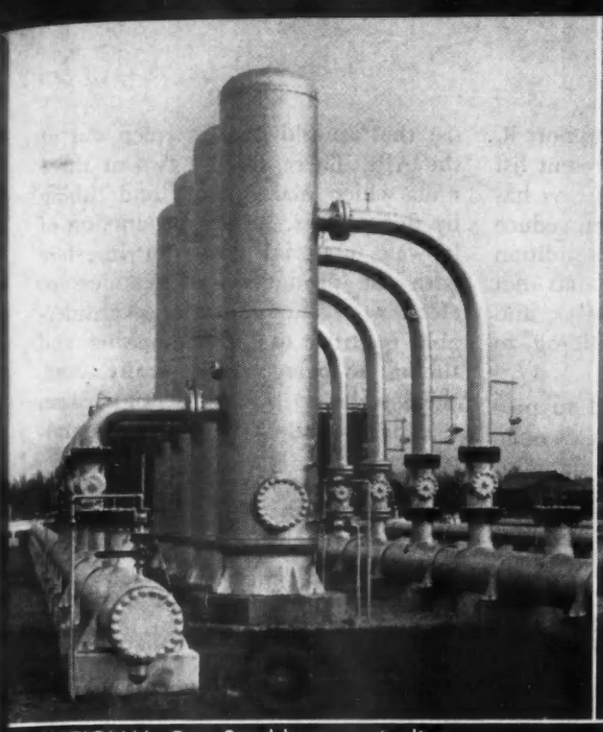
Result has been the production and use of high strength alloy tubing in a large variety of alloy steels and dimensions with consequent differences in chemical and physical properties and in cost. Tube walls heavier than standard are also in demand. Manufacturers can be of much more service than they have been in supplying this special tubing by helping the user select steels most economical for his conditions of service.

High strength alloy steel tubing is in considerable demand and, with the many sources of supply, is more readily available than high strength casing. It should be mentioned here that the pipe committee is not now contemplating the inclusion of requirements for corrosion-resistant pipe in its standard specification.

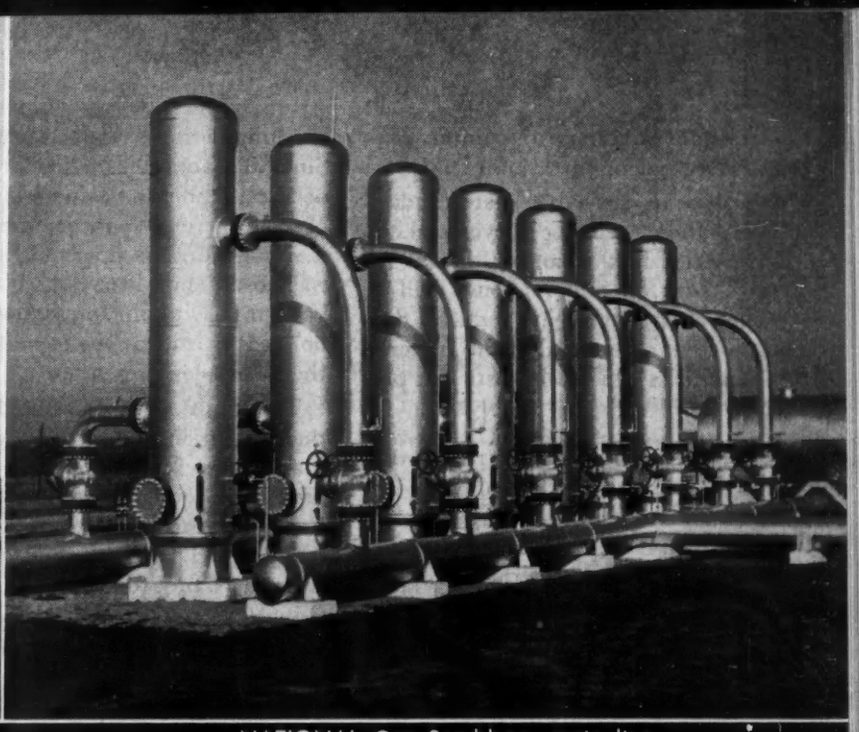
In response to specific demand, the pipe committee has been working for some time on a standard design of integral joints for tubing and casing, and also on standards for tubing with walls heavier than present standards. These items are being investigated by the research subcommittees. They tie into the high strength casing and tubing specifications discussed above, and are also to be available for J-55 and N-80 grades.

Twofold problem. The integral joint problem logically has been divided into two parts: the first dealing with joints employing API threads, and as nearly as possible, API dimensions; the second part considers joint designs involving special threads, special dimensions, and probably mechanical seals. Considerable progress has been made on the first phase, but the second is more complicated and has many more controversial points to be settled before any standard design can be agreed upon.

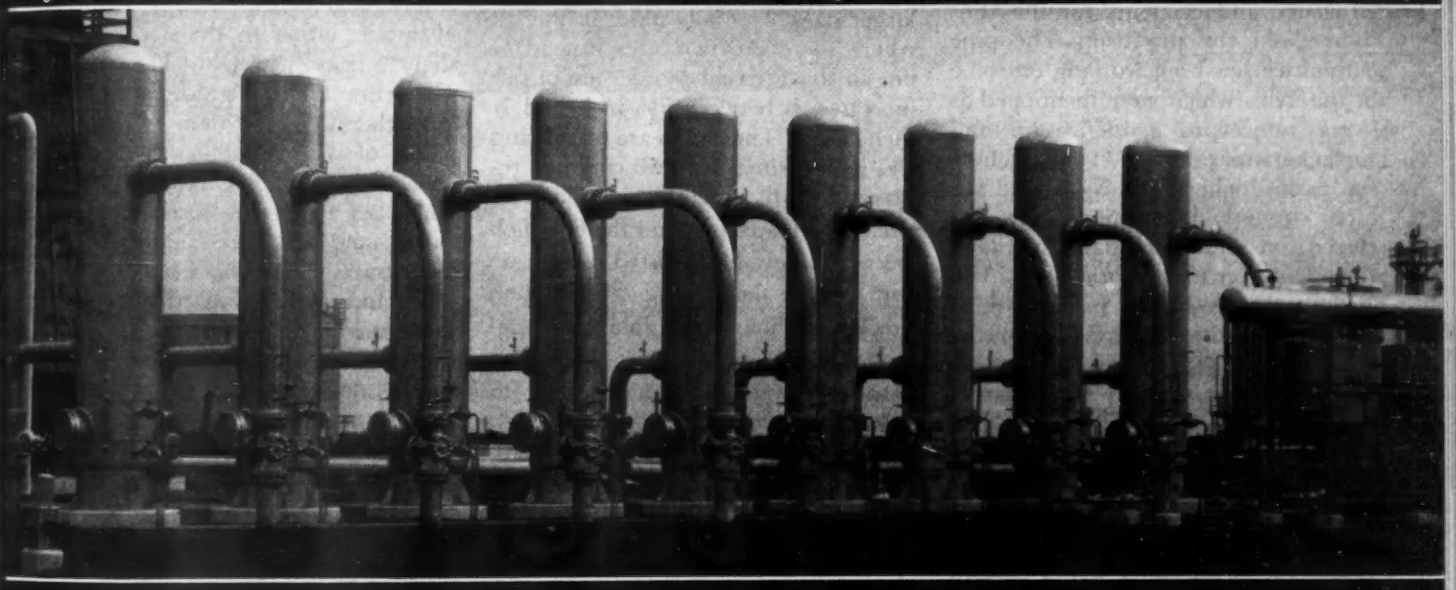
High pressures constantly being found emphasize the need for heavier walls in oil well tubing, as well as for higher strength grades. Wall thicknesses agreed upon must hold the pressures indicated and lend themselves to all the problems involved in mill production and field use. Furthermore, there is the possibility, even the probability, that heavier wall, larger outside diameter couplings will be nec-



NATIONAL Gas Scrubbers, main line gas booster station, Batesville Miss.



NATIONAL Gas Scrubbers, main line gas booster station, Monroe, La.



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essary for obtaining maximum leak resistance out of these joints.

It appears probable that standard specifications will be developed on these items in the not-too-distant future. Work on integral joints will be wasted if the petroleum industry does not present a demand for this material in quantities which will justify its production.

Formative stage. High strength drill pipe specifications are also in the formative stage. Specifications on drill pipe for use with welded-on rotary connections have been agreed upon, as well as specifications on drill pipe with integrally forged connections.

In a paper presented at the 1953 Annual API meeting, Jay W. Owings suggested that the time had come to study the API list in the interest of efficiency and economy for the consumer and the producer. The pipe committee has been working on some of the items which were mentioned as being subject to simplification and further standardization. These include the grade higher than N-80, and the high strength joints previously discussed, on which standard specifications have yet to be worked out. The API committee has no jurisdiction or control over the non-standard grades or joints which Owings included in his picture last year. It is, of course, hoped that the time will arrive when most or all of these will no longer be needed because of development in API standards.

The pipe committee did give consideration to the reduction of present roll sizes and made a special investigation to obtain the consensus of each API district in the elimination of grade H-40, and included grade F-25.. It also gave consideration to the adoption of one thread length instead of the present short and long threads, all with the thought of possibly reducing the number of items specified in our standards.

Circumstances explained. Reports of these studies were presented at mid-year meetings last June. Full consideration failed to develop any basis for action by either users or manufacturers, and the matter has been dropped. Here is the author's version of the why's and wherefore's leading up to this negative result.

There is an adequate basis for the present casing size selection, and there is a long period of usage to support it. Since the adoption of the present list of sizes, tendency of users always has been to increase it rather than reduce it. No drilling or operating condition is known, however, which has not been met with the present sizes, and no real justification for adding to them has been presented.

The mills have continued to produce casing in standard roll sizes only, inasmuch as regulations were removed which previously made it necessary for them to do so, and it is to everyone's best overall interests that they stay with the standards.

Starting with 4½-inch casing, sizes increase on the ratio of approximately 12½ percent, with due allowance in actual percentage of increase necessary to use already existing roll sizes and maintain required clearances in larger sizes. The only place in the list where there are two sizes instead of one in this rational progression of size increases, is between 5½-inch and 7-inch casing. These sizes are 6-inch and 6⅝-inch casing. The two could be replaced by a 6¼-inch outside diameter size. Both the 6-inch and the 6⅝-inch casing already had existed, and were sizes in the low-tonnage production bracket, although still in regular demand. Going to the tremendous expense involved in changing over to this 6¼-inch size has not been justifiable so far. Demands change with conditions. It, therefore, may be practical to make the change later on, or even to eliminate one of the present sizes.

The ratio of increase in size is as large as it should be to protect the variety of casing programs required to meet all operating conditions. Widening the gap to make fewer sizes or the elimination of any of the existing sizes could cause difficulties in meeting all conditions and could react to the economic disadvantage of the user by limiting his selectivity, with consequent increase in tonnage. Casing sizes must not be eliminated which might be the only one capable of meeting certain specific conditions of use.

In the opinions obtained on the elimination of grades, there was little objection to eliminating grade F-25, which covers lapweld material, although one district did not want to see the lapweld process ruled out of the API. There are but two or three mills which make casing and tubing by this process. As the production of lapweld material does not interfere with the production of seamless or electric-weld items, and as a considerable quantity of lapweld casing and tubing is being economically used, there seems to be no essential reason to remove grade F-25 from the standard.

Distribution by grades and weights. Each API size starts out with an F-25 item which has a wall thickness as thin as, or thinner than, any other item listed. This is, therefore, the item with the least strength in its size because of the combination of the thin wall and the low physical properties of the grade.

The next item is usually in the H-40 grade, either in the same or in a slightly heavier weight. The physical properties of this grade are higher and, therefore, the item is more capable of withstanding the possible collapse, tensile, and internal stresses which are necessary to consider when casing and tubing is applied to oil well usage. From there on, the H-40 items increase in wall thickness and performance properties, but the increments are spaced widely enough apart to hold the number of items at a practical minimum.

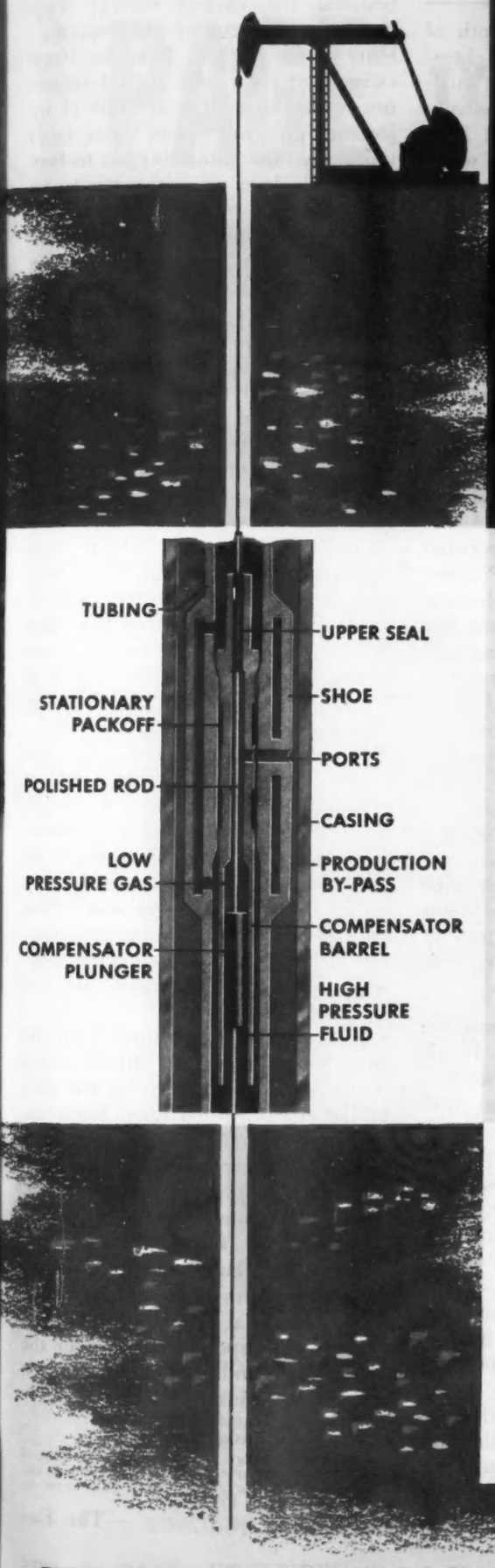
When the wall thickness in grade H-40 has increased to a point where the desired increase in performance properties can be picked up by the grade J-55 to advantage, it proceeds in the same manner, and then on into grade N-80. This rational basis of grade and weight distribution reduced the number of specified items tremendously. It is necessary to make exceptions to any set system when justified, and this has been done. Reference is made to 8⅝-inch, 24-pound, J-55 casing which has about the same performance properties as 8⅝-inch, 28-pound H-40 casing; and 7-inch, 26-pound, J-55 casing which duplicates the performance properties of 7-inch, 23-pound, N-80 casing. Each standard was necessary to satisfy the special requirements of a particular district. Otherwise, the list consistently maintains a uniform rate of progression in performance properties. The chart contained in API Bulletin 5C2, "Per-

SOMETHING FOR NOTHING

sounds mighty appealing, but like "lifting yourself by your bootstraps," it is in violation of the basic laws of science. Therefore, when we first told oil men how much weight reduction could be expected from a Rod Weight Compensator, they were skeptical and started calling the Compensator "Operation Bootstrap." That was when "Bootstrap Joe" came into being and we like to think of him as symbolic of the mighty upward thrust delivered midway down the rod string by the application of the hydrostatic pressure on the Compensator plunger.

But now the story has changed. Operators have witnessed installation after installation where the dead weight of the sucker rod string has been reduced by 33%. Now they are telling us it isn't "Operation Bootstrap" at all — that a Compensator is actually a two stage counterbalance with part of the rod load balanced out half way down the well. Others tell us we have placed an upside down pump in the middle of the rod string, and the lower pump only moves the fluid to the Compensator on the upstroke, while the Compensator boosts it to the surface on the downstroke.

We still like to believe in "Bootstrap Joe," but we don't argue. We do know that an Oilmaster Rod Weight Compensator permits more oil to be produced from greater depths than any other known means of sucker rod pumping. If deep well pumping is your problem, we suggest you get in touch with your Oilmaster Representative for further details on the...



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formance Properties of Casing and Tubing" is a graphic illustration of the spacing of casing sizes, weights and grades described.

From the above explanation of grade selection, it can readily be seen that the elimination of H-40 items would leave remaining the lightest J-55 item to take their place or the necessity of developing substitute items. The pipe committee found no technical reason why grade H-40 should be eliminated and, therefore, there is no objective in so doing unless the grade J-55 items could be adjusted in a manner which would protect the users' economy.

A partial answer would be to provide new items in grade J-55 with walls light enough to balance out the difference in cost between the two grades. It was concluded that such walls would be too thin in many cases to be satisfactory from a manufacturer's or user's standpoint. The only other way to conclude the matter would be to eliminate the small differential between the cost of the two grades. As sales prices are not within the scope of specification work, the API pipe committe has no authority for considering that phase of the matter.

Basic thinking expressed by all API districts was that further simplification of grades would offer no advantage to the user. One district wanted more items in grade N-80, as well as in grades J-55, if grades F-25 and H-40 were eliminated. A manufacturer did not want to have grade H-40 eliminated because it served as a protection to the mill on heats of grade J-55 which might run under the minimum strength of 55,000 psi for that grade.

Revisions progressing. All standard pipe specifications are now in the process of revision to reflect the approved actions taken at the pipe committee meetings last June. Specifications have been strengthened by the deletion of provisions subject to agreement between the purchaser and the manufacturer wherever possible. By doing this, the specifications are on a more positive basis, and more clearly reflect what is to be expected when material is purchased under them.

API Standard 5L, "Specification for Line Pipe" and API Standard 5LX, "Specification for High-Test Line Pipe" are to be re-issued late in 1954. Important improvements and additions will be found in both of them under the stipulations for chemical requirements; mill product quality tests and dimensional controls. Grade "C" has been removed from Standard 5L in the interests of weldability control. Further important changes in Standard 5LX include the addition of requirements for the qualification of welders and welding procedures at the mill, the addition of welding and weld-testing controls on submerged arc welded pipe, and the reduction of allowable wall thickness tolerance for large diameter pipe.

Many of these changes are the result of the active part taken by API pipe committee members on Subcommittee 8: Gas Transmission and Distribution Pipe, a section of the American Standards Association Sectional Committee B31 on Code for Pressure Piping. It is expected that the Section 8 part of the code will be issued late in 1954. It will incorporate these API line pipe standards and the line pipe to be produced under these revised standards will be adequate to meet all code requirements of use. Subcommittee 9 on Oil Transportation Piping (another new section of B31) has started recently to produce a code for its specific type of usage. It is expected that the revised API line pipe specifications will be acceptable for those uses also. If not, the committee shall make every effort to meet their special demands.

New plastic pipe subcommittee. An API Subcommittee on Plastic Pipe, recently appointed, will work in close contact and cooperation with the pipe divisions of the Society of Plastics Industry, Inc., and other society committees on plastic pipe and fittings. The goal is, of course, to develop standard specifications for plastic pipe which will be suitable for oil field application.

Standards must not become static or inflexible. Whenever there is a justifiable need to do so, the pipe committee intends to incorporate alterations and additions to keep them as abreast of current demand as the time necessary for development, study, and working out of pertinent specifications will permit. —**The End**

Profile Logging . . .

Continued from Page 151

zone every time the pumping rates are changed. Figure 3 shows three injectivity profiles of the same well as used in the example of Figure 2. The second survey was run shortly after the first, and the third survey was run months later. The good agreement between the various surveys lends proof to the accuracy and reproducibility of the method. It is also interesting that the profile should remain nearly the same after months of injection. This well takes water fairly uniformly throughout its open section. The high level of radioactivity on the logs of Figure 2 between 1203 and 1207 feet is thought to indicate a settling of the gravel pack with a corresponding volume of space available for the accumulation of radioactive water.

Figure 4 shows a survey of a well which does not take water uniformly over an entire perforated interval. The well was perforated over an interval of 31 feet from 1743 down to 1774, but the bottom 16 feet of perforations was taking 90 percent of the water. The sand from 1743 to 1758 is known to be productive from both core analysis and electric logging data, yet only 10 percent of the water is leaving the well bore at these depths. If the vertical permeability of the sand is low, this could be an undesirable profile.

Figure 5 is a profile of a well for which comparatively little data is available. All of the water is leaving the well fairly uniformly in the interval between 1884 and total depth at 1907 feet. This corresponds closely with the section that was shot at the time of conversion to water injection, and indicates that the shooting technique was very successful in this instance.

Figure 6 shows two surveys on the same well. The initial survey shows nearly all the water leaving the well behind the cemented liner. Remedial work to seal off the liner was performed. The second survey indicates that this work has been successful, with all the water now being injected into the proper formation.

To date a large number of wells have been surveyed successfully and it is believed that this technique will perform an important service for the oil industry and that its application will receive widespread use.

ACKNOWLEDGMENT

The authors are grateful to the management of The Texas Company for their cooperation in this development and for permission to have these results published.

—**The End**

One piston tubing anchor keeps tubing in hole longer—cuts well pulling costs

PAGE* TYPE R TUBING ANCHOR

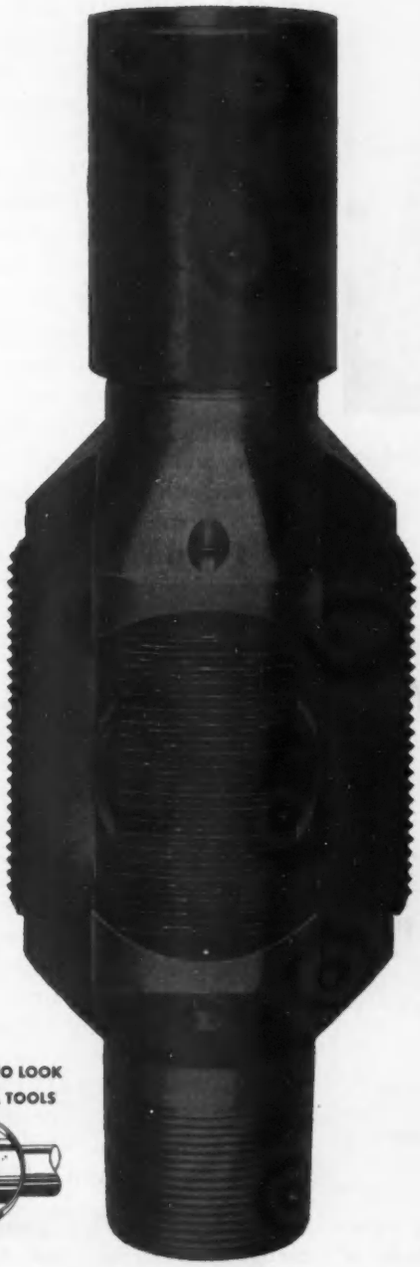

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Fig. 1—Countercurrent stripping tower alongside trailer-mounted laboratory used to develop closed system for treating sour brine for injection.

How to Prepare a Sour Brine For Subsurface Injection

A new idea in removing H_2S from flood water cuts treating costs to one mil per barrel.

By TODD M. DOSCHER, Shell Development Company, Houston, and **ROBERT N. TUTTLE,** Shell Oil Company, Tulsa

THE LABORATORY was actually taken into the field to develop a method of preparing hydrogen - sulfide bearing brine for subsurface injection. The Shell Oil Company, with the cooperation of the Shell Development Company, designed and constructed a trailer - mounted laboratory for the specific purpose of evaluating and testing water-treating methods as well as testing the quality of injection water in the field rather than hundreds of miles away in a central research laboratory. The first problem encountered by the new field laboratory was that of working out a method of preparing a non-plugging injection water for flooding oil pools in the Benoist and Cypress formations of the Illinois Basin when starting with an ex-Devonial sour brine. Figures 1, 2 and 3 illustrate portions of the trailer-mounted laboratory.

It was not enough to prepare a non-plugging injection water from the sour brine, but the treated water had to be compatible with the brines produced from the oil-bearing formations. These brines contained approximately 50 parts per million of soluble iron, and are to be substituted in part for treated Devonian brine as the water cut of the produced fluids increased.

Inherent difficulties encountered when starting with a sour brine in the preparation of an injection water are: the produced, sulfide brine contains significant quantities of colloidally dispersed metallic sulfides (usually corrosion products), sulfur (if air is allowed to contact the brine), and (even after treating the brine with heat and chemicals) more than a trace of oily sludge. Assuming that the metallic sulfides, sulfur, and oily sludge can be removed by adequate settling and skimming, or filtration, the brine still would be highly corrosive. Although the corrosivity of the brine can be reduced with any one of a variety of inhibitors, it is not feasible nor may it be possible to eliminate corrosion completely. Therefore, even in well-inhibited brines, it is to be expected that some corrosion products will form. The use of corrosion resistant materials, such as plastic or cement lined pipe and tubing is a positive method of preventing the formation of corrosion products. Regardless of the intrinsic merit and economic feasibility of such materials, the hydrogen sulfide bearing brine could not be mixed with impunity with a brine containing dissolved iron, as in the case in question, because the job of having to filter large quantities of iron sulfide out of a brine would tax the performance of any filter. The only way to handle a hydrogen sulfide brine is to remove the hydrogen sulfide.

Present method not practical. The method in common use for the removal of hydrogen sulfide, the so-called open system, involves many steps, viz., aeration, chlorination, coagulation and filtration, and is generally unsatisfactory because: (1) aeration in open towers is incomplete; and unless large settling basins are used, expensive doses of chlorine must

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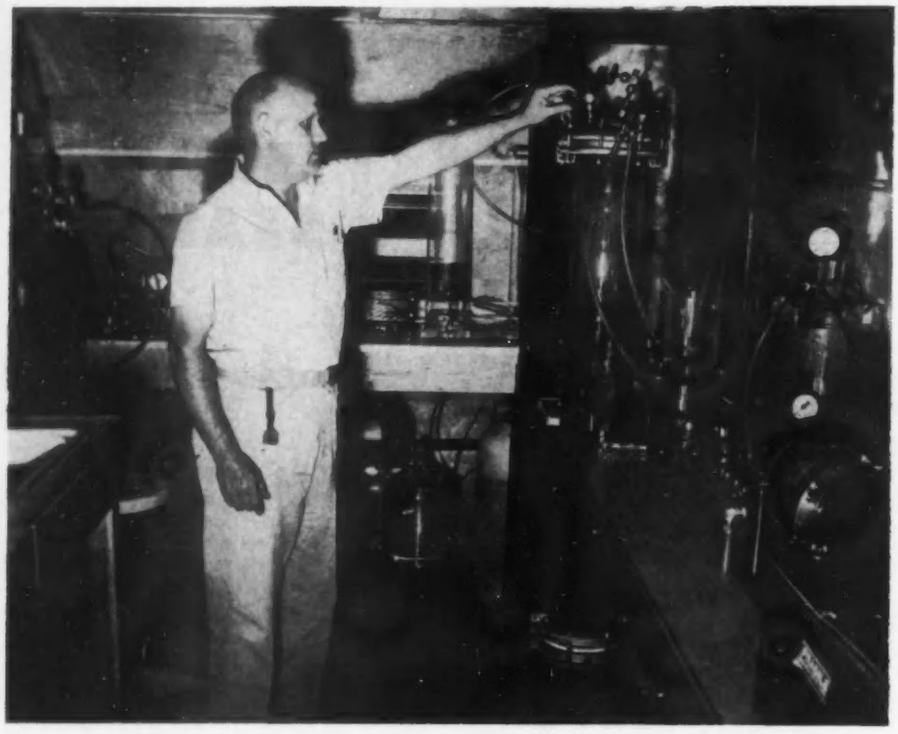


Fig. 2—Inside Shell's mobile laboratory showing view of treating facilities.

be used to scavenge residual hydrogen sulfide; (2) significant amounts of colloidal sulfur are formed during the aeration process, and subsequent filtration is made more difficult; (3) if the brine is not deaerated and is to be combined with a brine containing soluble iron, adequate and economical filtration will be more difficult to achieve because of the presence of gelatinous colloidal iron oxide in the filter influent; (4) the aerated water is very corrosive and corrosion occurring downstream of the filters causes the injection water to become loaded with corrosion products. Corrosiveness of the aerated brine may be offset by deoxygenation (by either a physical desorption process or chemical reaction) and/or the use of chemical inhibitors, sequestering agents and resistant materials.

A closed stripping method. In view of these difficulties and the necessity of adding treating steps to compensate for the associated ill-effects of previous steps, consideration was given to removing the hydrogen sulfide in a closed system A stripping procedure in which the products of combustion of natural gas or petroleum are used appeared to be very attractive, and experiments were therefore carried out to determine the effectiveness of such a method.

Theory of the stripping operation may be summarized as follows: the solubility or concentration of gas, X_1, in a liquid is related to the partial pressure, P_1, of that gas in the gas phase in equilibrium with the liquid. The relationship may be expressed to a first approximation by Henry's Law: $X_1 = P_1/H$, where H is a constant for any given temperature. It follows that if the partial pressure of this solute gas is lowered by the introduction of a large amount of a second gas into the system then the solubility of the first gas must decrease. If fresh quantities of the second gas are constantly introduced, then eventually the partial pressure of the first gas will approach zero and consequently so will the concentration of that gas in the solution.

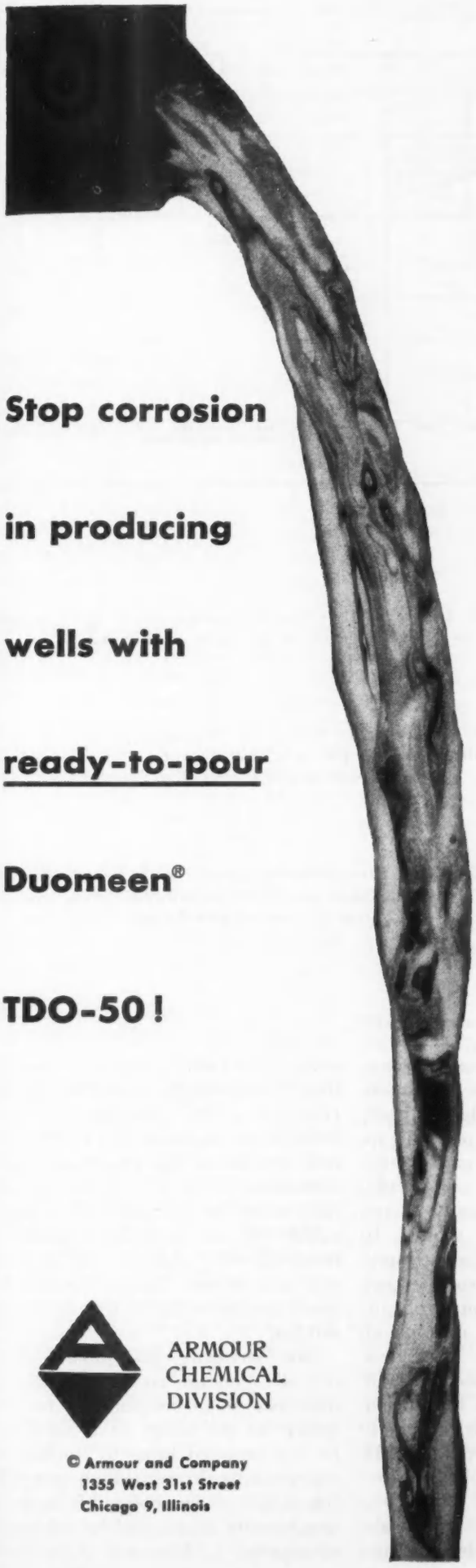
The process described is simply that of bubbling a second gas through a solution of the first one. Such a process is grossly inefficient; large quantities of the second gas and extremely long time periods are required to effect removal of the unwanted gas.

Increasing stripping efficiency. The process can be made more efficient by contacting the solution of the first gas with the second gas in a countercurrent column. This can be done in either a column packed with shaped stoneware pieces (designed to promote maximum liquid-gas contact and at the same time to minimize the pressure drop through the column), over which the liquid flows as a thin film, that is constantly being reformed and through which the gas rises by a tortuous path; or a tray type column in which liquid-gas contact is made by the gas bubbling up through the liquid, which, by the use of weirs on each tray, is temporarily retained on each tray as it descends through the column. A modifications of the latter type is the slat-tray tower, used in cooling towers and aerators, in which the liquid splashes down from one level to the next lower level and thus fresh droplet surfaces are exposed to the ascending gas stream.

Figure 1 is a photograph of the experimental stripping column. A glass column, 6 inches in outside diameter, 5½ inches inside diameter and 15 feet tall, was packed with one-half inch stoneware saddles. Effective heights of both 9 feet and 14 feet were used in the experiments. The Devonian brine was filtered through an anthracite filter prior to being sprayed into the top of the tower. Cylinders of compressed nitrogen gas and liquefied carbon dioxide were used as the source of stripping gas. The approximate tower height and ratio of gas to liquid which were to be used in the experiments to effect removal of hydrogen sulfide were approximated in advance by using published data and assuming

TABLE 1

Run No.	Liquid Rate G.P.M.	Gas Rate, C.F.M. at S.T.P.			Column Height Feet	Inlet Brine		Outlet Brine	
		Nitrogen	Carbon Dioxide	Total		H_2S p.p.m.	pH	H_2S p.p.m.	pH
1	0.25	0.55	....	0.55	14′	61	5.85	<0.1	6.9
2	0.25	0.50	0.07	0.56	14′	61	5.9	<0.1	5.9
3	1.0	2.0	....	2.0	14′	61	5.9	<0.1	6.9
4	1.0	1.8	0.25	2.05	14′	61	5.8	<0.1	5.9
5	3.0	4.0	1.0	5.0	14′	61	5.85	<0.1	5.8
6	1.0	1.7	0.3	2.0	9′	61	5.75	<0.1	5.85
7	1.0	0.85	0.15	1.0	9′	61	5.75	<2.	6.45
8	1.0	1.3	0.20	1.5	9′	61	5.75	<0.1	6.2



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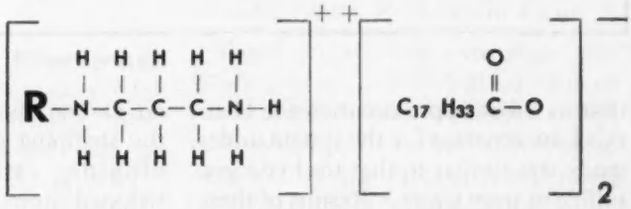

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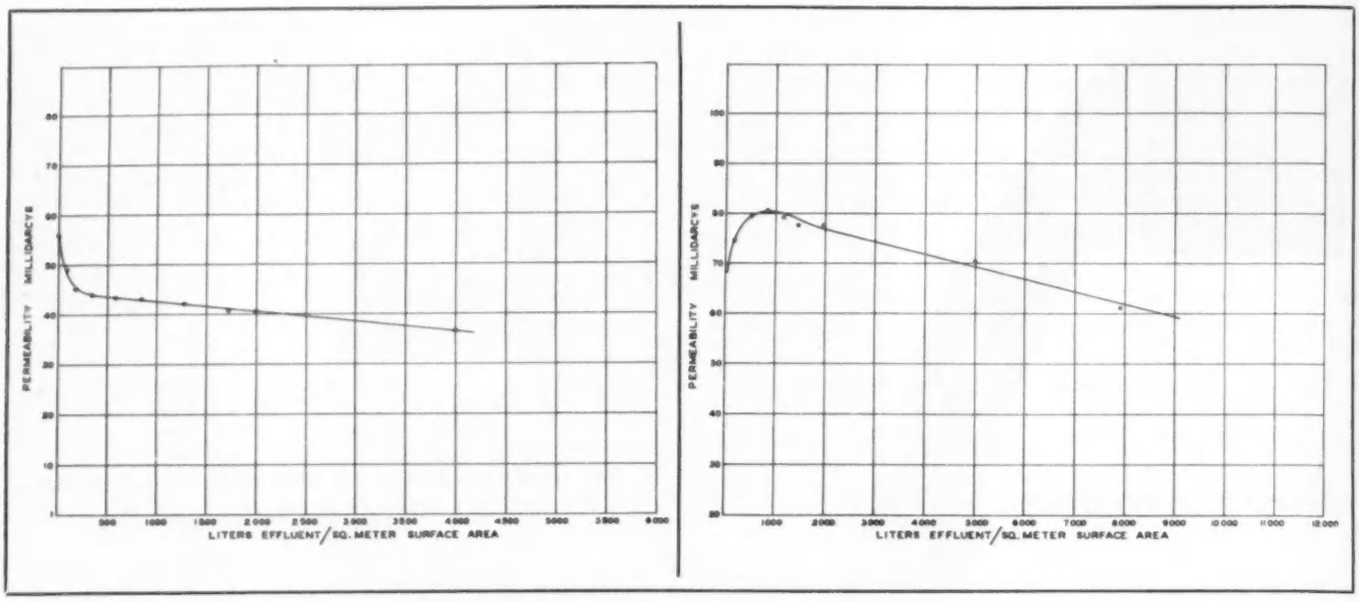


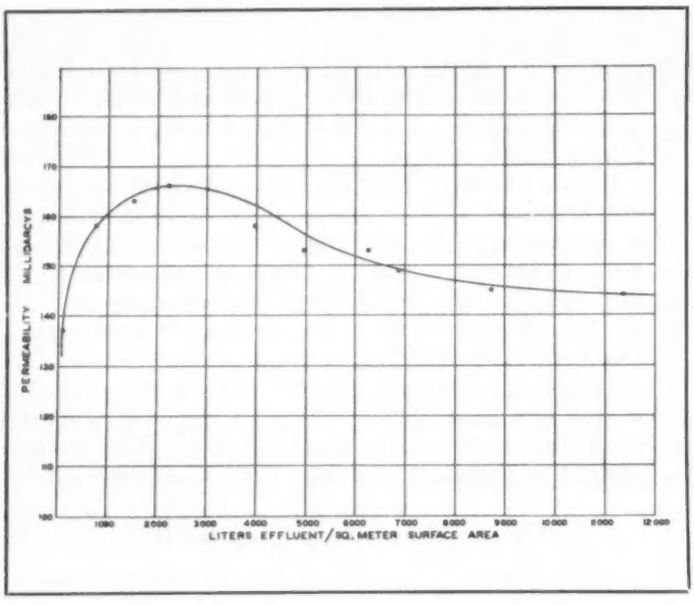


Fig. 3—(upper left) Permeability-throughput of brine in core test. Water filtered only prior to stripping.

Fig. 4—(upper right) Permeability-throughput of brine in core test when a second filter was used downstream of the stripping column. Note change in scale from Figure 3.

Fig. 5—(left) Permeability-throughput of brine in core test when the second filter was of the diatomaceous earth type instead of anthracite coal beds.

that to a first approximation the Henry's Law constant for the system under study was similar to that for hydrogen sulfide in pure water.[2] Results of these experiments are presented in Table I.

Carbon dioxide mixture best. From these results, it was concluded that hydrogen sulfide could be readily removed from the Devonian brine by countercurrent stripping with a mixture of nitrogen and carbon dioxide combined in ratios approximating those which are obtained when burning natural gas or petroleum with a stoichiometric quantity of air. The advantage of using combustion gas containing carbon dioxide rather than an inert gas (nitrogen or natural gas) is evident from the higher pH of the effluent in runs No. 1 and No. 3 when no carbon dioxide was used. When the stripping gas contains no carbon dioxide, carbon dioxide is itself stripped from the brine resulting in the deposition of alkaline earth metal carbonates and an increase in pH which increases the difficulty of removing the hydrogen sulfide. It should be noted that the stripped brine in all the experiments, except No. 7, produced no precipitate of iron sulfide when mixed with a sample of Benoist brine (34 p.p.m. of ferrous ion) or even when diluted with an equal part of a 100 p.p.m. ferrous ion solution in distilled water (ferrous ammonium sulphate buffered to a pH of 7).

Full scale operations. Full scale stripping operations can be conveniently carried out in stoneware towers, thus eliminating the possibility of any corrosion in the uppermost sections. It has been estimated that 15,000 barrels per day of the Devonian brine, containing 61 p.p.m. of hydrogen sulfide, could be stripped of hydrogen sulfide by the combustion products from 120,000 cubic feet of natural gas in a 4-foot diameter stoneware tower packed with 20 feet of 1-inch saddles.

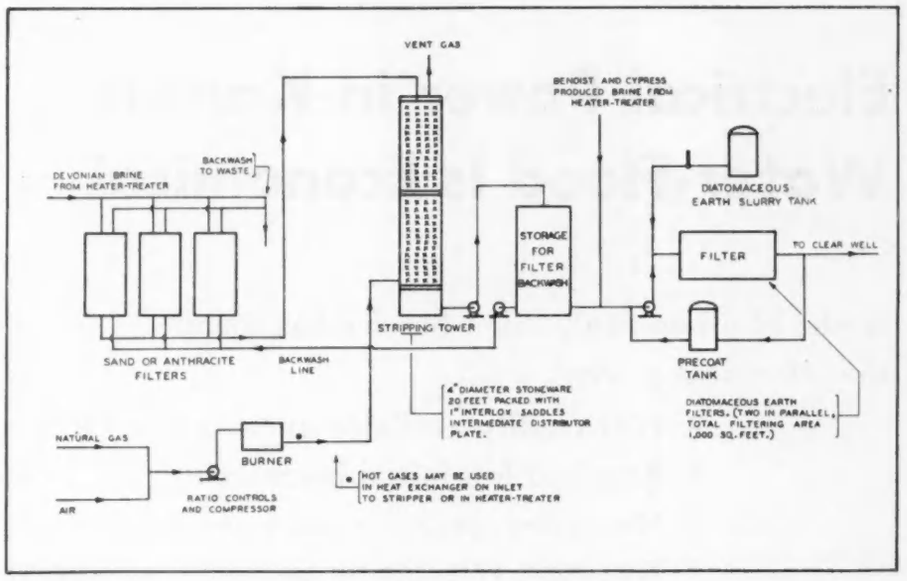
The stripping gas should theoretically contain no excess oxygen, otherwise some oxygen will be absorbed by the brine. It is necessary for the stripped brine to contain no oxygen as well as no hydrogen sulfide if it is to be compatible with an iron-bearing brine, and be relatively non-corrosive. However, it is likely

that small amounts of the order of 0.1 to 1.0 per cent may be tolerated without any ill effect. Combustion of natural gas with a stoichiometric amount of gas reputedly can be carried out with any one of a variety of burners that are presently available. Some burners are designed for submerged combustion, others are not. Conceivably, stack gases from a heater-treater could be suitably handled for use in the stripping operation.

Sludge removed. Efficiency of the packed tower, among other factors, is dependent upon the wetting of the packing by the fluid to be stripped. It is necessary to remove as much oil and oily sludge as feasible from the brine before introducing it to the stripping tower in order to guard against the possibility that the packing will become oil wet in the course of time. It is also necessary to remove other solids to prevent the column from becoming plugged or channeled. Therefore, it is essential to provide some degree of filtration upstream of the stripping tower. An anthracite filter is suitable for such use. The one drawback to the use of such a filter, however, is the increasingly poor efficiency of removal of the oil and oily sludge, which adhere to the surfaces of the preferentially oil wet coal particles, by backwashing. Increased backwash efficiency may be obtained by using hot water or steam in the backwash cycle.

Second filter used. The filter effluent from the coal filter used upstream of the stripping tower in the field experiments was not completely free of colloidal materials. This is to be expected considering the sieve sizes of the coal used in such filters, and also from the fact that without any enforced coagulation occurring before filtration, there is little opportunity for a *schmutzedecke* to build up on the filter bed. Also, if the combustion gases are not perfectly freed of oxygen, some colloidal sulfur will form in the stripping tower. Hence a second and finer filtration step, following the stripping of the hydrogen sulfide from the brine, was indicated to be necessary.

Core injection tests with the experimentally prepared water confirmed this conclusion. The Devonian brine which was filtered through a bed of anthracite coal and then stripped showed a marked tendency to plug cores from the Benoist and Cypress formations. This was indicated by the result of a typical core test shown in Figure 3. Additional core tests were made on the same brine which was filtered through a second coal filter following the stripping operation. Quality of the water was obviously improved as judged by the slope of the permeability-throughput curve of Figure 4. (Note the difference in scales between Figures 3 and 4.)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FILTER
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HOT GASES MAY BE USED IN HEAT EXCHANGER ON INLET TO STRIPPER OR IN HEATER-TREATER

Fig. 6—Schematic flow diagram of water treating plant resulting from field laboratory studies.

Diatomaceous earth filter tried. The injected brine still contained 0.03 p.p.m. of colloidal materials. Still further tests were carried out in which working scale model of a leaf-type diatomaceous earth filter (having a filtering area of 0.5 square foot) was substituted for the second coal filter. A pre-coat of 8 pounds of asbestos fibers per 100 square feet of filter surface was used together with a body feed of 50 p.p.m. of a relatively coarse diotomaceous earth. A filtration rate of 0.5 gallons per minute per square foot of filter area was used in these tests. The permeability-throughput curve for this water (Figure 5) is still better than for that water which was filtered through a second coal filter. The injected brine now contained 0.005-0.02 p.p.m. of colloidal material. Further tests with finer diatomaceous earth are in progress. Simultaneously, tests are being carried out to determine whether changes in the operation of the wash tanks upstream of the first coal filter will result in a reduction of the amount of sludge carried through to the diatomaceous earth filter. It appears that it will be possible to use diatomaceous earth filters to prepare a sparkling brine at a cost of approximately 1 mil per barrel and with filter cycles of no less than four days.

A flow sheet of the proposed water treating system in shown in Figure 6.

Based on previous experience, the finished brine, which will contain no more than traces of hydrogen sulfide and oxygen, will be sufficiently noncorrosive so that little gain will result from the use of corrosion inhibitors. On the other hand, it may still be necessary to use small amounts of the sequestering agents mentioned above in order to keep the products of whatever corrosion that does occur in solution. **—The End**

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ACKNOWLEDGMENT

Presented at the 18th Technical Conference on Petroleum Production at The Pennsylvania State University, State College, Penn., Oct. 6-8, 1954.

Electrical Power in Kansas Water-Flood Is Economical

In the Madison field, Cities Service has found that electrical power . . .

- **Was readily available at favorable rates.**
- **Required less initial investment.**
- **Meant less operating and maintenance costs.**
- **Was more versatile for automatic operation.**

By FRANK BEACH, Cities Service Oil Company, Bartlesville

PRELIMINARY STUDIES of the Madison Block of Greenwood County, Kansas, showed that electric power would be economical for water-flooding. This field of 985 acres and 101 wells has run the full gamut of primary production, gas repressuring and finally water-flooding.

Although the Madison field was under gas repressuring, it was realized that the produced gas would diminish quickly when water-flooding was started. Some of the factors which influenced the decision to use electrical power for water-flooding were:

- Electric power was readily available at the lease.
- Power rates were favorable.
- Motors were less than half the cost of engines.
- Motors were more adaptable to automatic operation.
- 25 to 35 per cent less labor needed for operation.
- 95 percent saving in maintenance labor.
- Smoother application of power.

Field Application. The usual water-flood development program is to establish a pilot water-flood to determine whether the formation will flood successfully. Thereafter, if the pilot is successful the remainder of the development is made in successive stages of as much development as can conveniently be accomplished in a year's time. The Madison Block was developed under this system.

The pilot flood was started with five input wells in December, 1948, with input water produced and pumped by gas operated engines. The flood was gradually expanded until 1951 at which time many of the oil wells were producing beyond the capacity of the jacks and central powers. In December, 1951, the first stage of the electric system was installed.

Electricity was purchased on the lease at a primary voltage of 12,400 volts. Primary lines were constructed to various points on the lease where transformers reduced the voltage to 440 volts for secondary transmission. Later as the flood progressed, additional electric lines were installed until the whole block was under electric operation. Figure 1 shows the layout of the electric power distribution system of the Madison Field.

The electric motors required to power the various water-flood equipment are as follows:

3—60 hp motors to power high pressure pumps in the filter plant.
1—7½ hp motor for backwash pump.
1—25 hp motor to power the turbine type pump at the river.
1—135 hp motor to power the deep well pump.
1—7½ hp motor to power a salt water disposal pump.
1—7½ hp motor to power a fresh water supply pump.
49—10 hp motors to power oil well pumping unit.
13—10 hp motors to power oil well pumping units yet to be installed.

A total of 70 electrical units with a combined horsepower of 982½ will ultimately be required to handle the water-flood requirements of the Madison Block.

Investment Costs. The electrical investment costs for the Madison field may be divided into two parts: (1) investment required for transmission lines, and (2) investment required for prime movers. Cost of the entire field transmission system including poles, wire, transformers, and capacitators was $39,074.

Investment for prime movers including switch boxes, wiring and installation labor is detailed as follows:

3—60-hp motors for hp pumps	$ 4,400
1—7½-hp motor for backwash pump	330
1—25-hp vertical motor for turbine pump	760
1—7½-hp motor for fresh water supply	330
1—7½-hp motor for SWD pump	330
49—10-hp oil well pumping unit motors	22,148
13—10-hp oil well units to be installed	6,656
1—135-hp deep well pump installation	10,000
Total Estimated Cost for Prime Movers	$44,954
Total Electrification Cost	$84,028

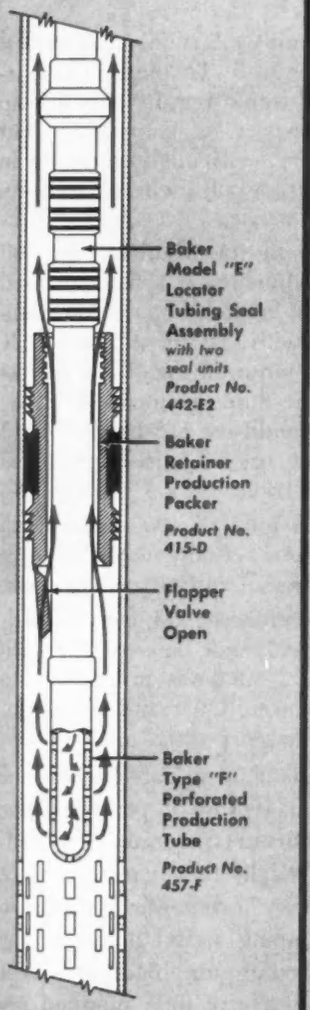
It should be brought out at this point that the cost of electrification of any water-flood project will depend upon the spacing, depth of the producing sand and thickness of the sand. The Madison field is developed on a 20-acre water-flood spacing. That is, one input well to every 20 acres. Had the spacing been 10 acres, there would have been twice as many input wells and twice as many oil wells to pump. The input water requirements would also have been twice as great.

For the condition peculiar to the Madison field, the cost per acre for electric installation is as follows:

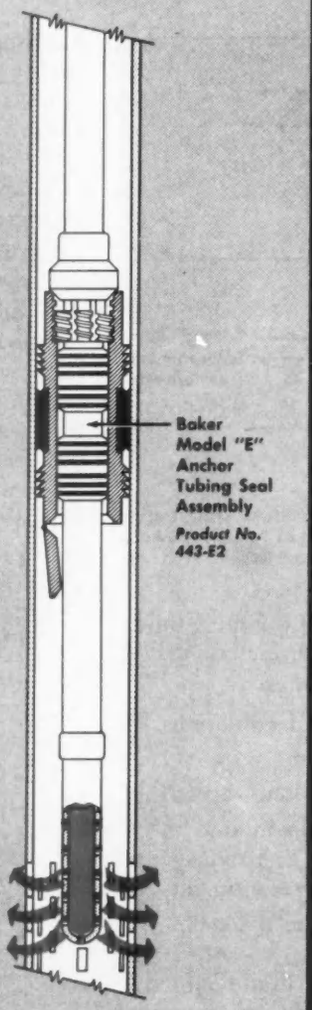
Total developed acres	985
Cost per acre for transmission system	$ 39.67
Cost per acre for prime movers	45.63
Total Electrification Cost per Acre	$ 85.30
Total Ultimate Installed horsepower	982½
Cost per installed hp	$ 85.22
Total daily theoretical fluid capacity—bbls.	75,056
Cost per barrel of capacity	$ 1.12
Total number of oil wells	62
Cost per oil well	$1,355

Power costs and fluid volumes. A summary of electric power costs by years is shown in Table 1.

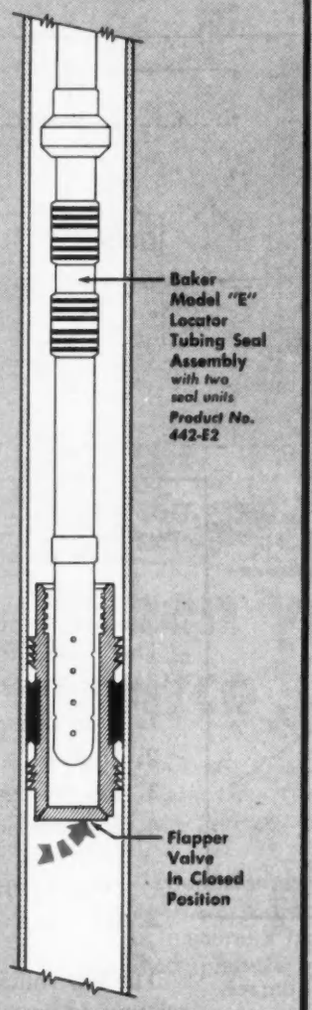
The total fluid handled by all elec-


Baker Model "E" Locator Tubing Seal Assembly with two seal units Product No. 442-E2
Baker Retainer Production Packer Product No. 415-D
Flapper Valve Open
Baker Type "F" Perforated Production Tube Product No. 457-F

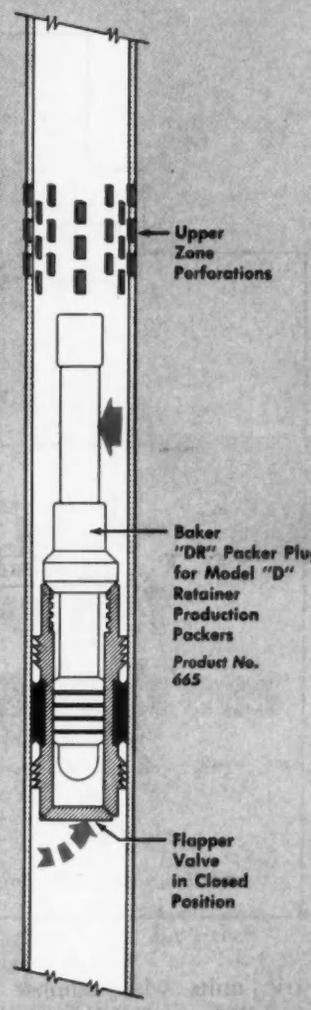
Washing or Circulating—Seals of Locator Tubing Seal Assembly removed from packer bore. Flapper Valve held open by tubing extending below the Packer.



Pressuring Below Packer—Acid or cement squeeze, formation fracture, gas or water injection. Anchor Tubing Seal Assembly is used when high squeeze pressures are required.



Isolate Zone Below Packer—Tubing String removed, Flapper Valve closed. Isolates pressure differentials (squeeze, production) from below the packer.


Upper Zone Perforations
Baker "DR" Packer Plug for Model "D" Retainer Production Packers Product No. 665
Flapper Valve in Closed Position

Temporary Bridge Plug—For working over zones above the packer. DR Plug is run in on Baker Retrievable Cementer and retrieved with overshot.

PACKS-OFF AND HOLDS UNDER HIGH BHT—Baker Retainer Production Packers will hold high pressures under conditions of high temperatures. Hundreds of Baker Packers are in successful service in Southwest and Gulf Coast areas where temperatures in excess of 300 degrees are not uncommon.

RESISTS CORROSION—The cast-iron used in the construction of Baker Packers is far more resistant to corrosion than the casing in which the packer is set, thus making it ideal for permanent installations, or for use in areas plagued with a severe corrosion problem.

EASILY DRILLABLE—The Baker Packer is constructed of drillable cast-iron, and its design supplements the breaking-up action of the bit. Whether it has been in the well for only a few hours, or for ten years, the Baker Packer can be drilled up in minimum time. Expensive and hazardous "milling-out" operations never are required.

IMPORTANT FACTS

Baker Packers are used in a majority of installations where conditions of extreme pressure, temperature, or depth are present. Baker Packers also dominate Dual Zone installations, particularly those involving two-packer, crossed-flow arrangements.

BUT IT IS ALSO TRUE that *more* Baker Packers are used for *simple single zone* completions than for *any other type of completion,* and that *most* Baker Dual Zone installations employ *only one* packer.

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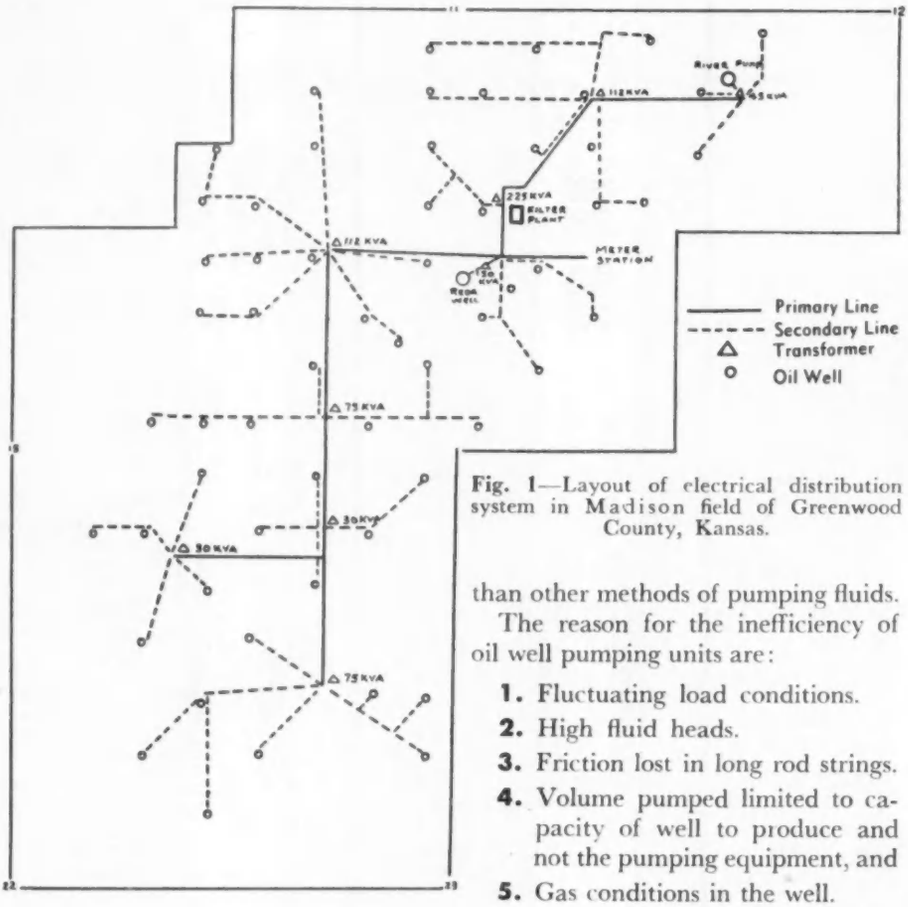


Fig. 1—Layout of electrical distribution system in Madison field of Greenwood County, Kansas.

tric units with number of barrels handled per KWH and the cost per barrel is shown in Table 2.

It is apparent that the fluid handled per kilowatt-hour has become less, and the cost per barrel of fluid handled has become higher. At the same time the power factor has improved and the demand has become less.

It is evident that the case of the increased cost is due to the increasing number of pumping units installed over the period. Inspection of the installed horsepower hours in relation to the fluid handled indicates that the pumping units are far less efficient than other methods of pumping fluids.

The reason for the inefficiency of oil well pumping units are:

1. Fluctuating load conditions.
2. High fluid heads.
3. Friction lost in long rod strings.
4. Volume pumped limited to capacity of well to produce and not the pumping equipment, and
5. Gas conditions in the well.

The low volume of fluid handled in relation to installed hp on pumping units suggests that perhaps the motors are too large for the volume of fluid being pumped.

Horsepower versus fluid pumped. A 10-hp motor should have the capacity to produce about 300 barrels of fluid per day from 1900 feet. However, the average fluid pumped from Madison Unit wells is only 102 barrels per day per well. To pump 102 barrels of fluid would require only a 5-hp motor. However, it is possible that many of the wells might increase in production to a point where the 10-hp motors are needed.

A survey of the Madison Unit oil wells as of January 1, 1954, indicated that out of a total of 49 oil wells equipped with 10-hp motors, only three wells required the 10-hp motors to pump the fluid produced. Twenty-four wells could use a 5-hp motor, 15 wells could use a 3-hp motor and seven wells could use a 7½-hp motor.

Out of a total of 490 installed hp only 254 hp is actually needed to produce the present capacity of the wells.

As of December, 1953, the comparison in Table 3 made between the various pumping methods in relation to the horsepower hours and barrels of fluid handled per day.

It is evident from Table 3 that the oil well units require 55 percent of the total hp hours to pump only 12 percent of the total daily fluid handled. Since there is more horsepower installed to power pumping units than for any other method of pumping, it is evident why the volume of fluid pumped per kwh has decreased since 1951.

The schedule of horsepower installation by years is shown in Table 4.

ACKNOWLEDGMENT

Excerpted from: "Economic Aspects of Using Electric Power for Water-Flooding in Secondary Recovery of Oil Producing Fields" by J. R. Hatfield and Frank Beach, Cities Service Oil Company, Bartlesville, Okla., presented at the Electrical Conference of the Petroleum Industry, Tulsa, Okla., Sept. 27-29, 1954, and sponsored by Petroleum Committee, A.I.E.E.

TABLE 1

YEAR	KWH	P.F.	Demand	Total Bill	Average Cost/ KWH
1951	419,200	55%	62-93	5,516	0.013
1952	1,190,400	71%	154-214	12,868	0.011
1953	2,541,200	77%	345-449	25,653	0.010
1954 (4 Mo.)	1,141,600	83%	414-483	11,141	0.010

TABLE 2

YEAR	Barrels Total Fluid	Bbls./KWH	Cost/Bbl.
1951	2,846,087	6.8	$0.0019
1952	5,373,142	4.5	0.0024
1953	8,176,912	3.2	0.0031
1954 (4 mo.)	2,986,277	2.6	0.0037

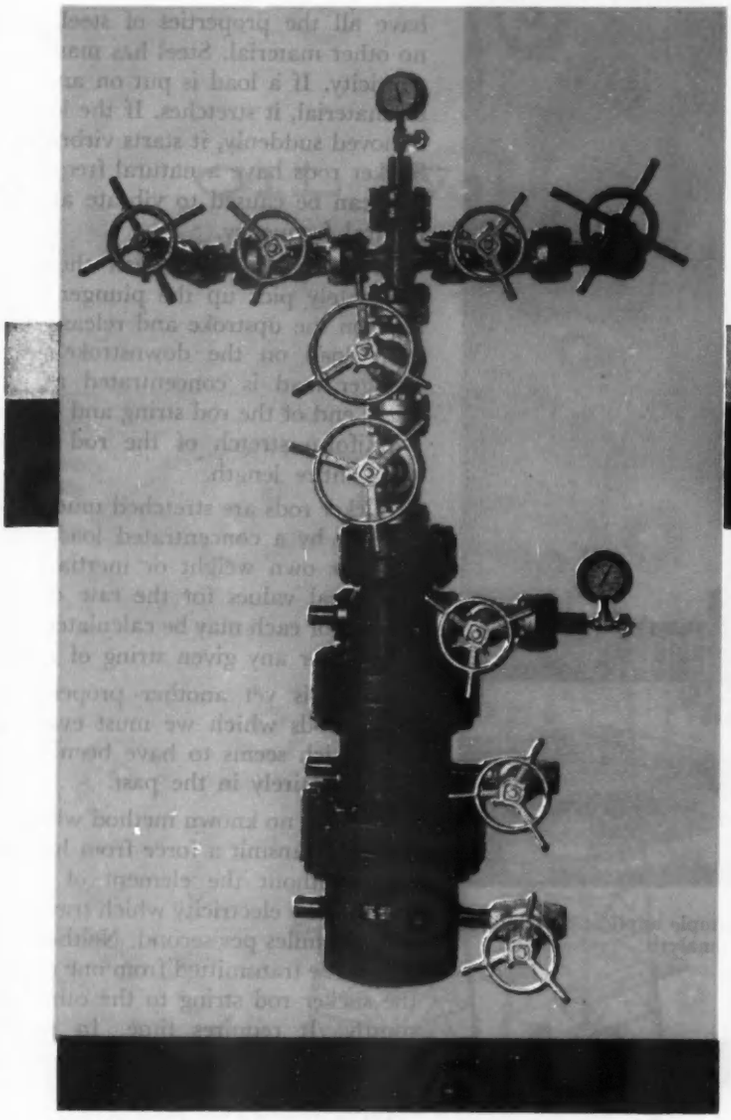
TABLE 3

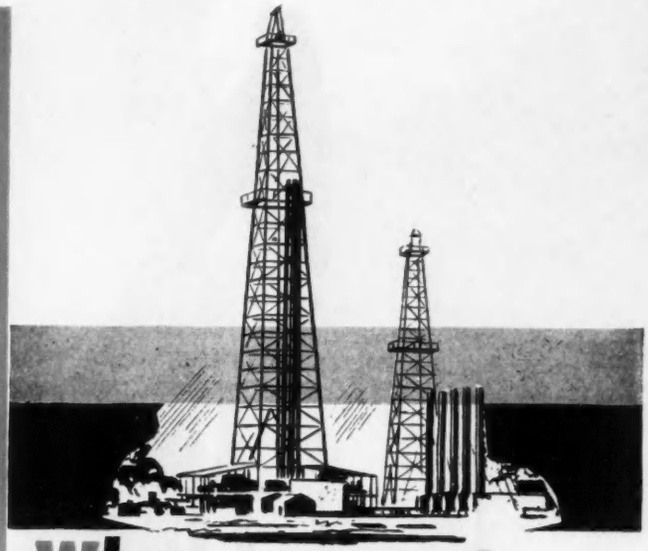
Kind of Unit	Units & H.P.	Daily H.P. Hours	Percent of Total	DAILY FLUID HANDLED		Fluid Pumped Per H.P. Hour	Fluid Head Pounds
				Barrels	Percent		
Oil Wells	49 x 10-H.P.	8,760	55.	4,449	12.5	0.51	870 lbs.
H. P. Pumps	3 x 60-H.P.	3,220	20.2	11,769	33.2	3.65	550 lbs.
Deep Well Pump	1 x 135-H.P.	3,240	20.3	8,531	24.1	2.63	695 lbs.
River Pump	1 x 25-H.P.	600	3.8	10,000	28.2	16.67	100 lbs.
Backwash Pump	1 x 7½-H.P.	4	0.1	300	0.8	75.00	45 lbs.
SWD Pump	1 x 7½-H.P.	53	0.3	200	0.6	3.78	100 lbs.
F. W. Pump	1 x 7½-H.P.	53	0.3	200	0.6	3.78	100 lbs.
Total	852	15,830	100.00	35,441	100.00	2.22	.....

TABLE 4

DATE	Pumping Units	High Press. Pumps	Backwash	River Pump	House Water	Deep Well	Total
1951	86	120	7½	25	0	0	238½
1952	250	120	7½	25	0	0	402½
1953	367	180	7½	25	7½	105	699
1954 (4 Mo.)	490	180	7½	25	7½	135	852

—The End





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MANY ILLS IN ROD PUMPING can be detected by the simple application of fundamentals to a new approach in dynagraph analysis.

New Approach Applied To Dynamometer Studies

Problems in rod-pumped wells can be solved by applying fundamentals in a new method of dynagraph analysis.

By J. C. SLONNEGER, Chief Consulting Engineer,
The Continental Supply Company, Dallas

A DYNAMOMETER CARD properly taken will reveal what is happening at the pump in the bottom of a well if the fundamentals of the rod pumping system are understood fully. These fundamentals often are overlooked or not used in the analysis of a dynagraph so that the pumping of an oil well generally remains a mystery. The dynagraph is a record of what happened in the rod pumping system and if its language is understood properly, much can be learned of the mechanical functioning of rod pumping.

Sucker rod behavior in oil well pumping has been the subject of innumerable theories and discussions and the reason for this is a failure to apply simple, and well known fundamentals.

Sucker rods are made of steel and have all the properties of steel, and no other material. Steel has mass and elasticity. If a load is put on an elastic material, it stretches. If the load is removed suddenly, it starts virbrating. Sucker rods have a natural frequency and can be caused to vibrate at that natural frequency.

In pumping an oil well the rods alternately pick up the plunger fluid load on the upstroke and release that same load on the downstroke. The plunger load is concentrated at the lower end of the rod string and causes a uniform stretch of the rod along their entire length.

Sucker rods are stretched much differently by a concentrated load than by their own weight or inertia. The numerical values for the rate of rod stretch for each may be calculated and plotted for any given string of rods.

There is yet another property of sucker rods which we must evaluate and which seems to have been overlooked entirely in the past.

There is no known method whereby we may transmit a force from here to there without the element of time; not even by electricity which travels at 186,000 miles per second. Neither can a force be transmitted from one end of the sucker rod string to the other instantly. It requires time. In sucker rods, force is transmitted at the rate of 15,800 feet per second. Thus with 8000 feet of sucker rods, it would require about half a second to transmit a force from top to bottom of the string or in the reverse direction. It would be possible to move one end of the rods fast enough to tear the rods apart before the other end could start to move.

Tubing, also made of steel, behaves like steel, and follows exactly the same laws. It can stretch and vibrate due to a change of load on the standing valve. If the tubing is anchored, only that portion below the anchor is free to obey those laws.

If these laws by which rods stretch are known, straight line curves representing stretch may be plotted just as a spring-operated weighing scale can be calibrated. Since sucker rods stretch obeys two different laws, there must be two straight lines representing the sucker rod stretch, (one for inertia stretch and one for concentrated load stretch), for every specific string of rods. Somewhere, somehow these cali-

TWO OIL WELLS FOR THE PRICE OF ONE

...a most tempting proposition and one that is fast approaching an economic reality.

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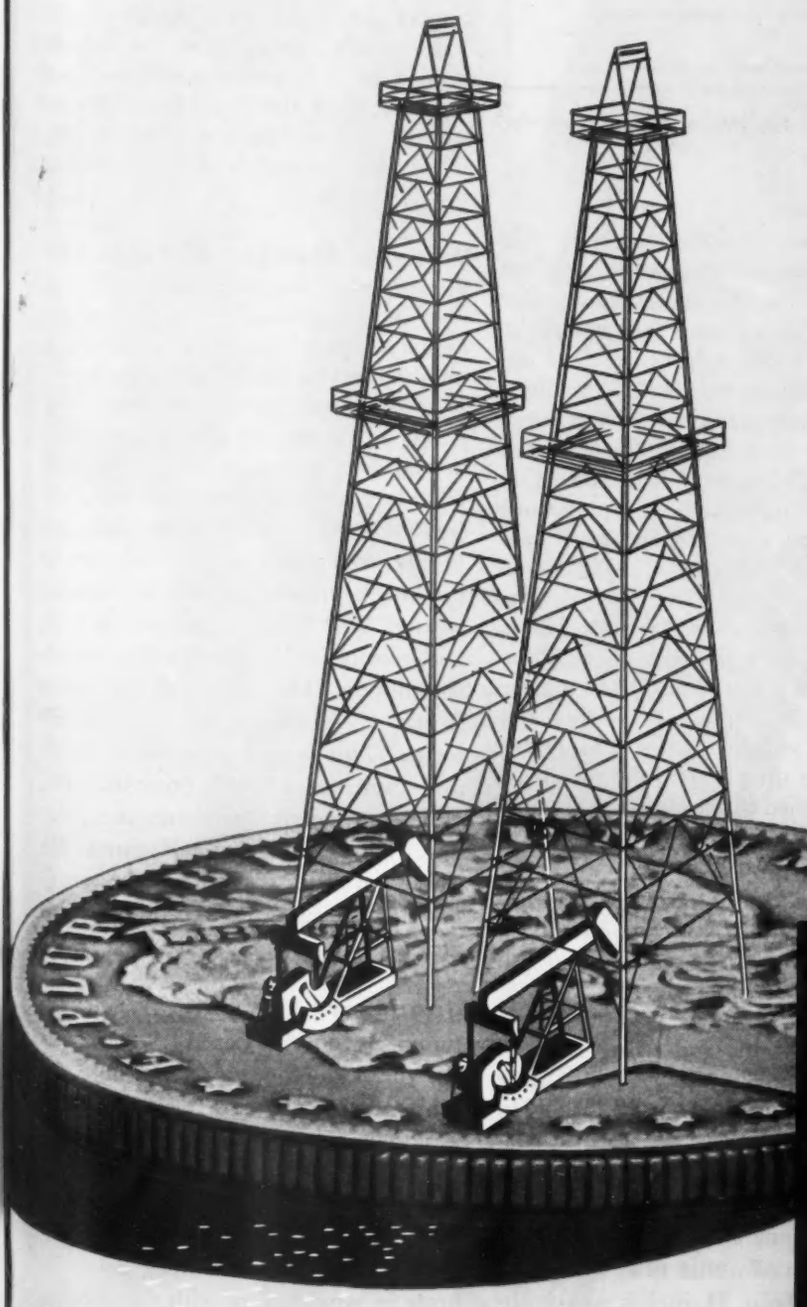

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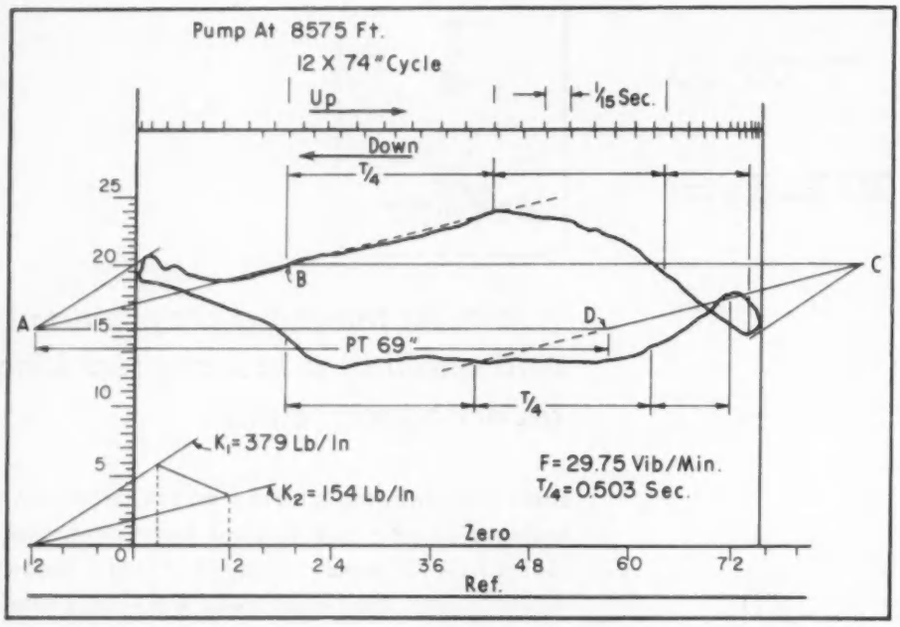

Fig. 1—Composite analysis of pumping well dynagraph by application of fundamentals.

bration lines should fit and explain their dynagraphs.

Fundamentals Applied. Figure 1 shows the application of these fundamentals to the analysis of a dynagraph. This dynagraph was taken from a well 8575 feet to the pump. The rod string was a combination of 1-inch, 7/8-inch and 3/4-inch rods. The line marked $K_1 = 379$ pounds/inch representing the calculated spring constant of the rod due to inertia was laid out first. For each 379 pounds of rod weight or inertia, the rods stretched one inch. Next, the line marked $K_2 = 154$ pounds/inch representing the calculated spring constant of the rod string for a concentrated load at the plunger was plotted. For each 154-pound load at the plunger, the rods are stretched one inch. The tubing in this well was anchored very near the pump, and so does not stretch or vibrate. It cannot affect the dynagraph and is accordingly out of the picture. Weight of rods, less buoyancy, is 15,550 pounds as weighed by the dynamometer and as calculated, and is represented by the line AD.

At the end of the downstroke and the beginning of the upstroke, the rods cannot have any load from the plunger. Therefore whatever load then exists, above the weight of the rods, must be caused by inertia; hence, the rods are stretched by inertia alone. Shortly after the beginning of the upstroke (about one-tenth second) this stretch becomes maximum. A line parallel to the K_1 line through the maximum point crosses the rod weight line at the point A, showing that the plunger overtraveled its static position about 13 inches. Force at the plunger is still zero even though the rods are stretched 13 inches by inertia. The plunger has to remain stationary until the rods are stretched sufficiently to support the fluid which will come upon the plunger. But, the concentrated load stretches the rods differently as along a line K_2. So, the line AB through A parallel to K_2 is drawn.

The line BC represents the total rod and fluid weight. When the polish rod reaches the point B, the rods have been stretched sufficiently to support the fluid load so the plunger begins to travel upward from point A.

But, here is the catch. It requires time to transmit that fact to the polish rod. For one-half second the polish rod keeps right on stretching the rods as though the plunger was stationary. Frequency of the rod string is 29.75 vibrations per minute or slightly more than two seconds for one vibration. In rod vibration there is always one-fourth of a wave in the rods. Thus, it requires one-half second to transmit force from one end of this rod string to the other. By this time the polish rod is at about 44 inches where the peak load occurs. Thereafter the load drops off and one-half second later the load is at the line BC. Over-stretching the rods has started vibrations.

Another one-half second later near the end of the upstroke, the vibration load becomes a minimum at which point the rods are positively stretched by the load along the line CD and negatively stretched by vibration. The plunger is now at the point D and there it stays while the rods reverse and unstretch. The rod vibration in this case is nearly cancelled out by the timing of the reversal but does cause the loop in the graph. Friction on the downstroke makes the rod weight appear less than their real weight, so that the rods vibrate around the friction load as evidenced by the intersection of the T/4 lines with the graph. The negative acceleration (or deceleration as it is sometimes called) of the rods near the end of the downstroke again increase the vibration and stretch out the rods back to the beginning point A.

Unsteady Plunger Motion. The plunger has moved from A to D and back again. However, the plunger remains at rest at the point A for about one-half second and again at the point D. The plunger motion was quite unsteady. This may be observed in part in rod line pumping. With the jack 2000 feet from the knock-off post, the jerky unsteady motion of the jack can be observed while the rod motion at the knock-off post is quite smooth and steady. The plunger motion is not, and cannot be the same as the polish rod motion. Here the polish rod had a stroke of 74 inches, the plunger 69 inches. This is a very excellent graph and indicates a good pumping job. Note that the rod frequency is almost exactly two and one-half times the stroke per minute. This may be designated a two and one-half order graph and is quite characteristic.

Unanchored Tubing. When the tubing is not anchored the analysis becomes more complicated because the tubing can come up with the plunger as it relieves the load on the standing valve, and can go down with the plunger as the load is transferred back to the standing valve. Worse, the tubing can, and sometimes does, vibrate in synchronism with the loading and unloading of the standing valve. The amplitude can become large

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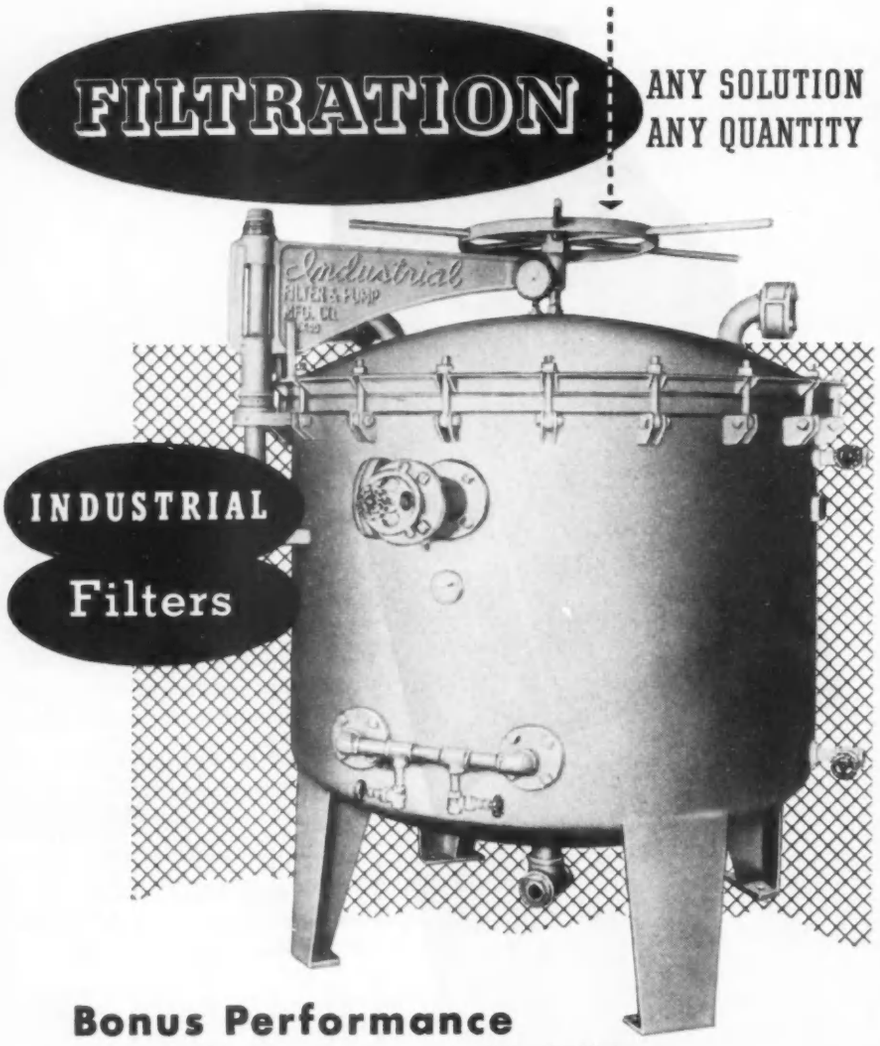

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RUBBER LININGS

enough to wreck both the rods and tubing.

Tubing Vibration. Sometime ago the graph shown at the top in Figure 2 was analyzed, although no reason was advanced as to why the analysis was required. Obviously something was very much wrong and while space precludes going into details of the analysis, it showed, however, that the sudden unloading of the rods was due to excessive tubing vibration which brought about the enormous vibration of the rods on the downstroke. Actually, the analysis showed that the tubing had an amplitude of 16 inches at the pump which means that the tubing was traveling up and down twice that or 32 inches. The operator was told this well would give lots of tubing trouble and surely some rod trouble. That was precisely why the analysis had been requested. The tubing was parting every ten days.

To overcome the trouble it was recommended that:

1. The tubing be anchored.
2. 75 feet of 1¼-inch polish rod be placed immediately above the pump to help push the plunger back.
3. The stroke be shortened from 64 to 54 inches.
4. The well be pumped at 22 SPM instead of 18 SPM to avoid synchronism with the rod string frequency.

This was done, but not having the one and one-fourth polish rods the operator substituted 100 feet of 1-inch rod above the pump. The lower graph in Figure 2 shows the result of that change in operation. The well was pumped in this manner for eight months without trouble. Production increased from 515 barrels per day, of which 70 were oil, to 595 barrels per day, of which 104 barrels were oil. At the end of eight months by working over the well, the operator succeeded in shutting out the water so it was no longer necessary to pump so rapidly to obtain the allowable.

Both tubing and rods are subject to stretch and vibration. Also that it does take time to transmit force a distance. But no matter how complicated a pattern these actions and reactions occur, it is quite possible to unravel a dynagraph and learn what happened at the plunger, if the fundamentals already known are applied. These fundamentals have been successfully applied to several hundred graphs in the writer's files and which have been completely analyzed.

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—because Sargent builds the best pumps and offers the most complete service in the industry. These are important factors in producing lower cost oil.

SERVICE Sargent recognizes the importance of pump maintenance and provides the most complete service facilities in the industry. This service is always available through conveniently located Sargent field stores throughout the country, which are staffed by company trained pump experts.

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PUMP METALS Sargent pioneered the development of special metals, and today offers a complete selection of pumps of metals to meet any and all well conditions. Through team work of management, research, engineering, skilled craftsmanship and practical experience, coupled with the most modern equipment and manufacturing practices, Sargent has endeavored to produce a completely reliable product which will gain, foster, and hold the good will* of the customer.

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Walking beam horsehead to keep vertical alignment of polish rods.

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Long stroke sub-surface hydraulically operated pump.

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Sucker rod hanger.

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Bottom support tubing liner pump.

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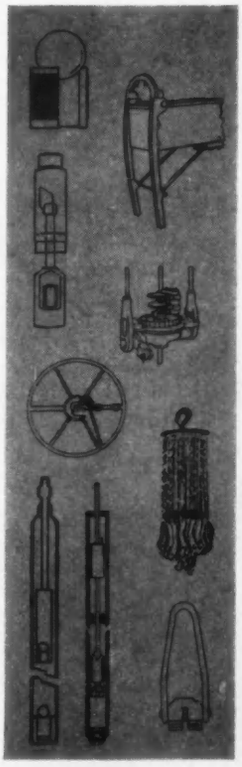
Sub-surface dynagraph.



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Fluid pounding. Pounding liquid or gas and gas locking are quite common troubles. Gas in the tubing changes rod buoyancy and makes it difficult to spot the true fluid weight and bottomhole pressure or fluid level. The echo meter method of determining fluid level is subject to grave error in gassing wells. The echo may be reflected from froth or foam and so results in false readings.

The graph shown in Figure 1 has an interesting history. When this well was first put on the beam, the pump was set at 5000 feet. At 17½ SPM which was quite right for that string of rods, it produced a very nice graph for 36 hours; then, it began to pound gas violently. Analysis showed that the pump should be lowered to 6800 feet to avoid gas pounding. The gas pounding stopped at the 6800-foot setting and the production increased so much that the operator decided to try a pump setting within 25 feet of the bottom, resulting in the graph shown. At the 5000-foot setting the well produced 33 barrels of oil and 117 barrels of water. At the 6800-foot setting it produced 104 oil and only 44 water. The remarkable difference in water cut cannot be explained by the dynagraph. That question belongs to the geologist.

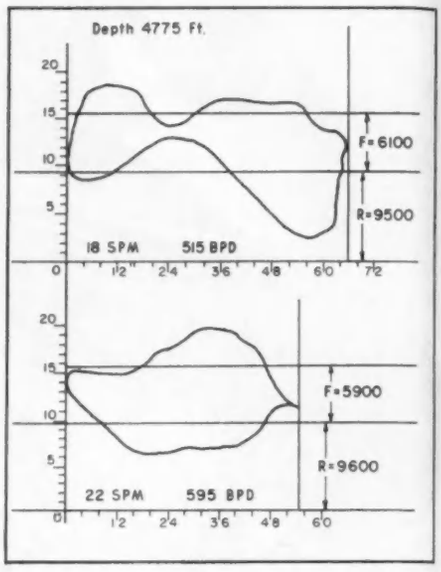

Fig. 2—Excessive tubing vibration indicated in top dynagraph. Same will shown in lower graph after trouble had been eliminated.

Energy transfer. By analysis it can be learned that rod vibration is caused by storing energy in the rod string either by inertia or by fluid load

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stretch. Sooner or later this stored energy must be released before the pumping cycle is completed. The magnitude of the vibration depends upon how this energy is released. In agitating wells having very little fluid load, vibrations due to inertia dominate, and it is quite possible to "cable tool" the rods, producing very large vibrations and ultimately rod trouble.

In one instance the polish rod load ranged from 18,000 pounds maximum to 6000 pounds minimum with only 0.59 horsepower at the polish rod. The rods were being "cable tooled". The well was flowing and the stored energy in the rod string could not be absorbed or transferred into lifting fluid. In Figure 1, there is a line connecting the line K_1 and K_2 so drawn as to represent the total transfer of inertia stretch energy to load stretch energy. Note that a line parallel to this line neatly fits the dynagraph at the beginning of the upstroke where that action must occur. This means that here all of the inertia energy of the rods has been put to work and that the well is being pumped at a very desirable cycle.

By analysis of the dynagraph in Figure 1, the total plunger travel (AD), and the work of the plunger (area ABCD) can be determined. From this transaction the true pump efficiency, the subsurface friction and efficiency can be calculated. With experience trouble causes can be recognized and means to overcome them can be devised.

To obtain the maximum production within the limits of the equipment requires that all operating factors must be at their best.

It is believed that the mystery of oil well pumping will disappear when the fundamentals already known are applied fully. —**The End**

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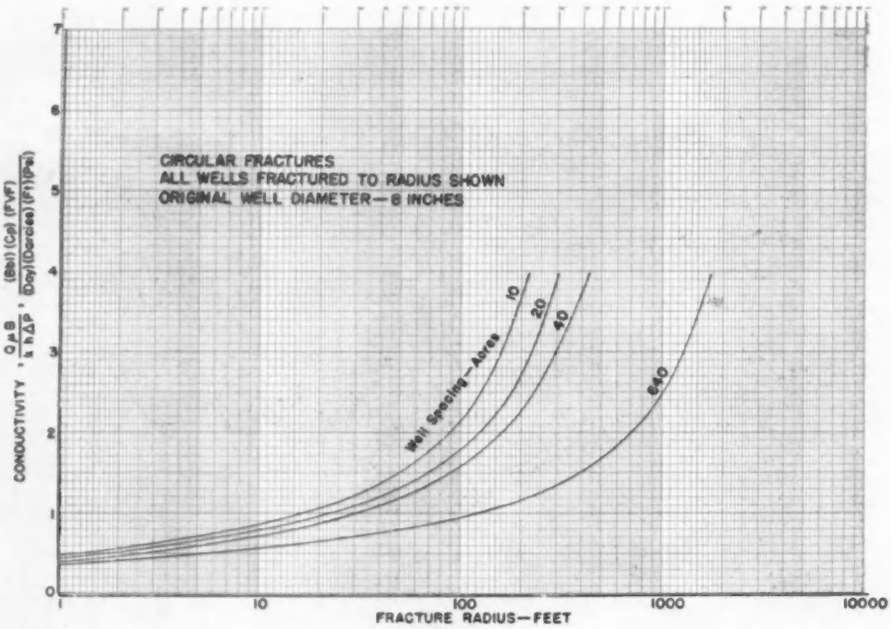

Fig. 1—Conductivity of horizontally fractured thin reservoirs five-spot pattern.

Water-flooding and gas cycling affected by . . .

Horizontal Fractures In Thin Reservoirs

Part 7: Conductivity of five-spot pattern.

By DR. PAUL B. CRAWFORD, Texas Petroleum Research Committee, Texas A & M, College Station, Texas

WIDESPREAD APPLICATION of commercial reservoir fracturing techniques has caused considerable speculation on the effect such fractures may have on water-flooding and gas cycling programs. The creation of fractures results in a decrease in the resistance to flow which is evident during primary production by an increase in production capacity. In water-flooding or gas cycling, the fracture increases the pattern conductivity.

If commercial fracturing is expected to result in a "pancake" fracture for the particular well and imposed fracturing conditions, it will be desired to create a fracture of optimum radius. One of the factors which will enter into this determination will be the pattern conductivity after fracturing. Primarily for this reason, studies were made to estimate the conductivity of the five-spot pattern when all wells were fractured with a circular "pancake" fracture.

An analysis. In analyzing the "pancake" fracture problem, a model reservoir was made in which single wire electrodes were used to represent the well and a thin circular copper disk was soldered to the wire to represent the "pancake" fracture. These fracture analogues were lowered into a model reservoir filled with a dilute salt solution, and the conductivity and isopotentials at the given conditions were measured and compared with the conductivity and isopotentials with only the wire electrodes in place.

From this study it was found that for the case of thin reservoirs, the circular or "pancake" fracture would have substantially the same effect on the pattern conductivity as that which would occur if the well were reamed to the diameter of the fracture. It is realized that such could only occur for the case of very thin reservoirs. In this instance the thickness of the reservoir divided by the well spacing was approximately 0.02.

The model which was used for this work was operated at steady state conditions, and the conducting medium was uniform and homogeneous. The liquid layer was level and of constant thickness, which corresponded to a constant permeability-feet product from input to output well.

The data indicate that for thin reservoirs substantially two dimensional flow will exist from one fractured well to another fractured well. In realization that the creation of a "pancake" fracture in a thin reservoir amounts to substantialy that of reaming a well it becomes possible to calculate pattern conductivities by methods which were presented by Muskat and Wyckoff[1]. The conductivity may be calculated for circular "pancake" fractures whose radii do not exceed the substantially circular isopotentials normally existing about an unfractured well.

For the five-spot pattern, these substantially circular isopotentials exist for a distance of approximately 25 percent of the well spacing. For a 660-foot well spacing, the isopotentials are substantially circular out to 150 feet.

Pattern conductivity. Conductivity of the five-spot patterns has been given by Muskat and Wyckoff[1]:

$$\frac{Q\mu\beta}{kh\Delta p} = \frac{3.451}{\log \frac{d}{r_w} - 0.6190}$$

Q = production or injection rate, bbls/day
μ = viscosity, cp.
β = formation volume factor
k = permeability, darcies
h = pay thickness, ft.
Δp = pressure differential, psi.
d = well spacing, ft.
r_w = well radius, ft.

In the above equation it will be noted that "d" represents the well spacing and that "r_w" represents the radius of the well. Under normal drilling and completion practices, radius of the well may be near 3 to 10 inches. If "pancake" fractures are created at each well, the effective well radius increases to approach that of the fracture.

Since model studies have indicated the validity of the assumption, the above equation may be used as a first

approximation to estimate the effect of fracture radius on the conductivity of the five spot pattern. The equation is plotted graphically in Figure 1. In preparing the figure, an original well diameter of 8 inches was assumed. All wells were considered to be fractured to the indicated radius with circular fractures.

From the figure it will be noted that if no wells are fractured in a 10-acre spacing, a conductivity near 0.49 may result. The conductivity of this pattern will be doubled if all wells are fractured to a radius of 12 feet.

Previous work has indicated the desirability of obtaining 30 to 50-foot fractures at each well. From the figure it will be noted that the pattern conductivity will be near 1.4 to 1.8. A fracture of 150-foot radius would result in a pattern conductivity of near 3.9.

The unfractured 20-acre five-spot pattern will have a conductivity near 0.47. The conductivity will be doubled if all wells are fractured to a radius of approximately 15 feet. It will be noted that fractures between 40 and 80 feet may be expected to result in conductivities near 1.4 to 1.9.

If no wells are fractured in a 40-acre, five-spot pattern, the conductivity has been calculated to be 0.45. The pattern conductivity is expected to be doubled when the radius of the fracture is equal to 20 feet. Fractures of 80 to 100 feet will result in conductivities near 1.7 to 1.9.

Conductivity of the unfractured 640-acre, five-spot pattern, is near 0.38. The conductivity is expected to be doubled if fractures of 48 feet radius are created at each well. Fractures between 225 and 400 feet will result in conductivities of approximately 1.4 to 1.9.

In comparing conductivities of the four well spacings it is indicated that it may be entirely possible to flood or cycle a fractured pattern with a large well spacing in a shorter time than may be possible to flood or cycle a smaller pattern that is unfractured. This is illustrated as follows: If a 10-acre well spacing is to be flooded, the conductivity if unfractured is near 0.49. In order to flood a 20-acre pattern in the same length of time as would be required to flood the 10-acre pattern, the conductivity must be twice as great as the 10-acre pattern.

From Figure 1 it will be noted that the conductivity of the 20-acre pattern will be equal to 0.98 if all wells are fractured to a radius of 17 feet. For a 40-acre spacing to be flooded in the same length of time as would be required to flood the unfractured 10-acre pattern, the conductivity of the 40-acre pattern must be four times as great as the unfractured 10-acre pattern. It will be noted on Fig. 1 that this occurs when all wells are fractured to 110 feet.

It should also be pointed out that since horizontal or "pancake" fractures exert such an appreciable influence on the pattern conductivity, it appears entirely possible that it may become profitable to flood or cycle thinner pays than has been practical heretofore. Inasmuch as the conductivity of the thin patterns may be increased substantially by fracturing and that fractures of desirable radius may not alter appreciably the swept area, there appears to be considerable evidence to support the belief that some thin pays may be profitably flooded or cycled after "pancake" fracturing.

Conclusions of study. Studies have been made of the conductivity of horizontally fractured thin reservoirs developed for five-spot flooding or cycling patterns. The studies indicate that the conductivities of the pattern may be doubled if the radius of the fracture at each well is equal to 12, 15, 20 and 48 feet for the 10, 20, 40 and 640-acre well spacings, respectively. Increases in pattern conductivity by factors up to eight or ten may be achieved, but they may not be desirable in every case. Previous work has indicated that increases in pattern conductivity by factors of three to four may be desirable, and these are indicated to occur when the radius of the fracture is approximately eight percent of the well spacing for the five-spot pattern. There appears to be some evidence to support the belief that larger well spacings may be desirable for flooding and cycling programs after creating horizontal fractures. It may be possible to profitably flood or cycle thinner pays after horizontally fracturing than has been possible heretofore.

REFERENCES

[1] Muskat, M., and Wyckoff, R. D., "A Theoretical Analysis of Water-Flooding Networks", AIME Trans., Vol. 107, P. 62 (1934).

To Be Continued

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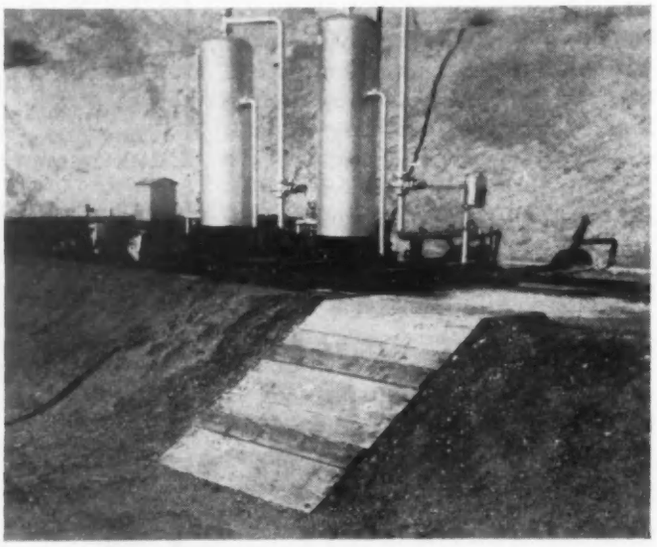
Hinged Railing Permits Access to Units

In order to keep cattle and other moving creatures away from the moving parts of a pumping unit, it is necessary to have a strong guard rail, but after the guard is in place, it usually hampers the pumper when he has to check the engine and pumping unit. A guard rail made from used sucker rods and wire netting may be made with hinges on each post so that a large portion of the guard rail will swing out to permit free access to the engine or unit.

Only two solid posts with hinged connections are used in this installation, one on either side of the unit midway between the engine and the pumping unit. With these two posts made of two-inch pipe and set in concrete, the entire structure may be opened out if necessary. The guards are made up from frames of sucker rod material covered with a light wire mesh. As shown, the two back pieces are built on a right angle so that they fit together at the back of the engine and are hinged at the solid post midway between the unit and the engine. The front pieces are also made at a right angle to fit against the unit just ahead of the crank counterweights so that it is impossible for anything larger than a mouse to get near the swinging counter weights.

If the crank or any part of the back side of the unit is to be worked on, the pumper unhooks the railing and swings it clear; conversely, if the engine is to be touched, the back pieces are swung free as shown.

Cleated Ramps Cut Dike Maintenance



A problem for operators who must maintain earthen dikes around tank batteries, traps and other installations is that of keeping men from walking on the dikes and gradually tearing them down. One operator solved this problem in an inexpensive way by building simple wooden ramps which rest directly on the earthen dike.

Differing from the common stairway and platform type of installation, the latter being one which involves considerable welding and other fabricating work, this ramp is built of inexpensive light lumber. The ramp is equipped with one by six-inch cleats which prevent a man from slipping. Securely imbedded in the dike, this ramp will not move or be undermined by rains or wind. It lies flush with the surface and, because of its relatively low cost of construction, several such ramps can be placed at strategic points around the enclosed area, thus encouraging their use by field men.

Painted with an outside-type durable paint, the ramp is easily seen. The small amount of materials and labor involved in constructing such a ramp will be offset by the man-hours spent in continually rebuilding and resurfacing of the earthen dikes.

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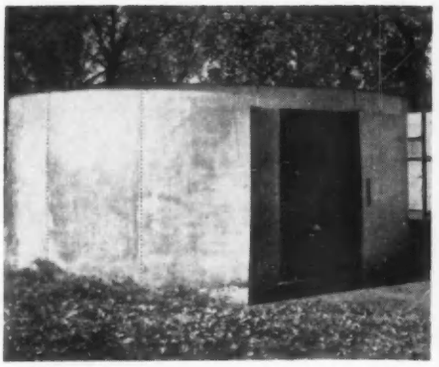
The ever present danger of fire around a tank battery, particularly in a light crude oil producing area, can be considerably reduced by the procedure followed by one operator in a northern Montana field. A pumper or gager usually throws oily rags in any convenient receptable whether it is close to a tank or is somewhat removed from it.

By keeping tank areas clean and free of potentially inflammable rubbish, much of the hazard is removed. Provide the elevated rectangular metal bin pictured in the accompanying photograph, and, encourage the field men to carry oily rags out to this receptacle, located some 50 feet from the tank battery area.

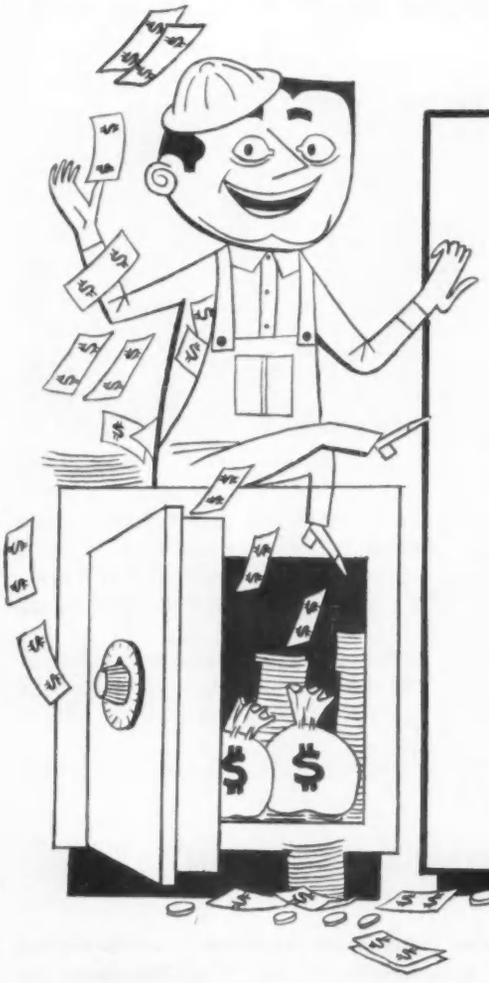
Bolted to a two-inch iron pipe post, the galvanized iron bin, attached to 1 by 12-inch boards and, in turn, bolted to the pipe, provides a handy place to store such rags. Because of its moderate size the container will not hold many rags and thus cannot cause spontaneous combustion. The receptacle has a sloping, hinged cover which, when closed, provides rainproof protection to the rags. It is inexpensive to build and will pay out its costs many times over as insurance against fire hazards.



Use Junk Tank to Make Garage or Storage Room

Where low stock tanks are used for crude storage in corrosive fields, the bottoms of the tanks and the lower parts of the sides are the first to be corroded. One pumper made his own concrete slab for his garage in a circular shape to fit the used tank, and rebuilt the tank next to his trailer house for a garage and storage room.

Because the top of the tank was rusted, the holes were patched and the top placed on it as it was in the field, using new gaskets to keep out



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"46" Rods Used in Crossroads Field Since 1949

Magnolia Petroleum Company's Santa Fe B-1 well, in the Crossroads Pennsylvanian Field at Crossroads, N. Mex., has been a steady producer since 1949. It is presently pumping 16 bpd of 48-gravity oil from 9750 ft. No water is being encountered.

The well is equipped with Bethlehem "46" sucker rods: 2450 ft of 1-in., 2550 ft of ⅞-in., and 4750 ft of ¾-in. This rod, made of nickel-molybdenum alloy steel, is fully normalized and fully tempered, and is especially intended for heavy-pumping duty. And it's been giving a good account of itself. Although the Santa Fe B-1 has been in operation nearly five years, no rod failures have ever been encountered.

Bethlehem is always ready to serve when you need sucker rods or accessories. And to make sure that you get the right rod for a particular fluid condition, we make carbon or alloy rods in five types. If you would like to have detailed information, get in touch with the nearest Bethlehem office or sucker rod distributor.

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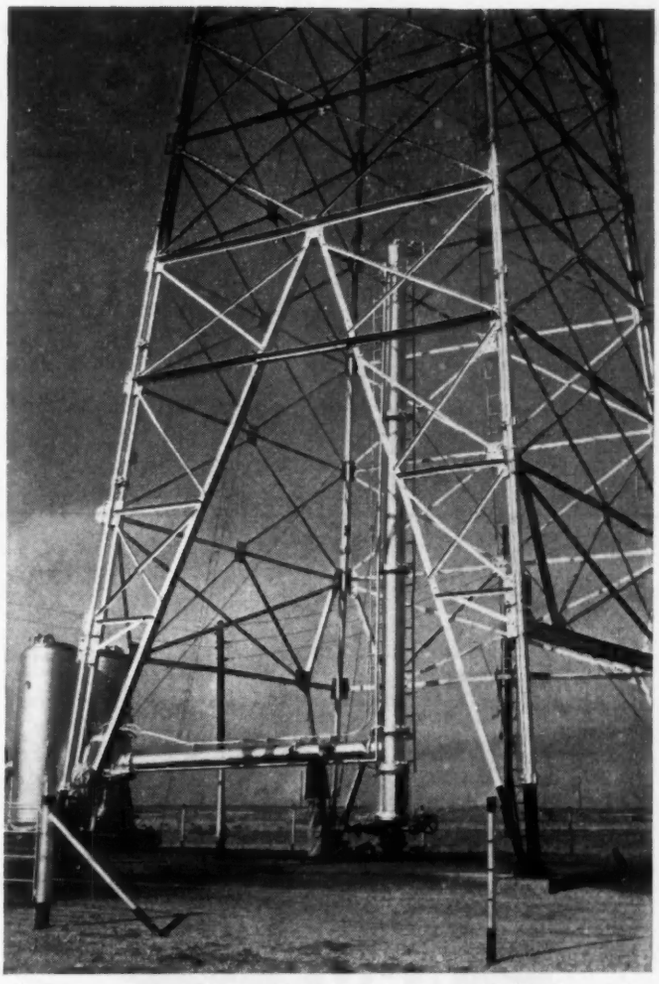
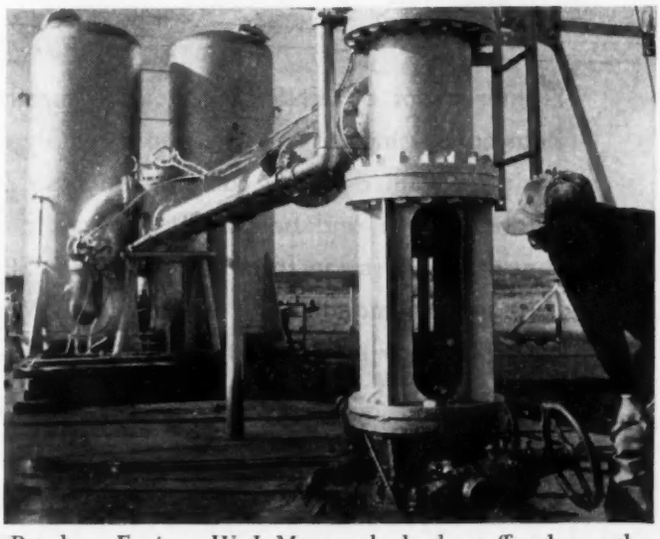


Showing topside of Santa Fe B-1 well, Crossroads, N. Mex. The well, owned by Magnolia Petroleum Company, Dallas, Tex., has used Bethlehem "46" sucker rods since going into production in 1949.



Petroleum Engineer W. J. Mannas checks the stuffing box as the polished rod makes its 25-ft stroke.

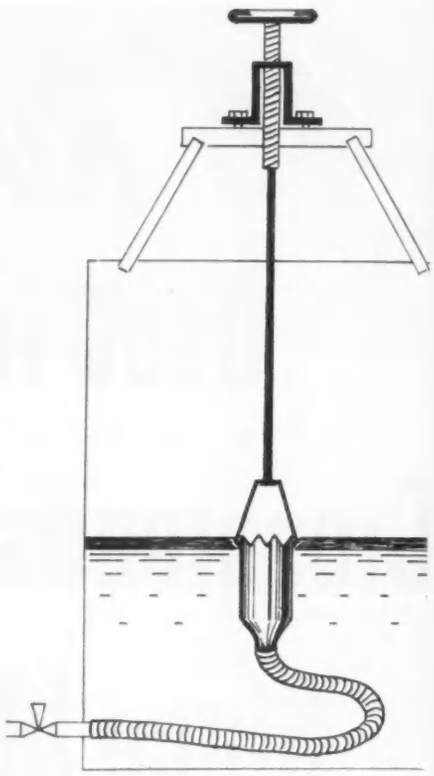
BETHLEHEM *Sucker Rods* BETHLEHEM STEEL

the rain. After the tank was in place, hinges and hasps were welded on, then the doors cut out so they would swing outward. This made a tight garage and storage room with no cost except for the concrete slab which was made from leftover cement used on other lease construction and well cementing.

The extra space on the sides of the car provide adequate space to put objects that cannot be kept in the trailer house.

Make Adjustable Skimmer From Old Pipe Line Valve

This adjustable oil skimmer in use on a water flood project has enabled the pumper to make slight changes in the height of the skimmer bucket to increase recovery of carried-over oil. Water is dumped in a large skimming pit from the gun barrels of several tank batteries. Since large quantities of water are handled, some oil is carried over into these skimming pits.



Normal practice is to skim off this oil, dump it into a sump and pump it into the stock tanks, or into a flow line to the heater-treater for further treating.

This adjustable skimmer is made from a salvaged pipe line gate valve, using only the valve stem, wheel and upper body of the valve. This assembly is bolted to a platform extending from the sides of the skimming pit.

The skimming bucket is of 7- or 8⅝-inch casing with serrated top edges. Bottom of the bucket has been swedged down to about three-inch outside diameter and connected by means of a flexible hose to the waste oil sump. From here the oil is picked up by a centrifugal pump and transfered back into the stock tanks or into a flow line for further treating.

The valve stem was welded to a section of pipe, the bottom of which contains a small flange. This flange supports the bucket bracket, and permits the pipe to rotate without effecting the bucket. By turning the valve handle at the top, the position of the skimmer bucket can be lowered or raised as conditions warrant. In this manner, more efficient skimming action results.

JENSEN'S WRIST PIN ASSEMBLY . . .

Further proof of JENSEN'S superior construction. The bearing housings of the wrist pin assembly are cleverly designed with a heavy compression type rubber strip located above and below the bearing to absorb the shock and vibration from the well load. Stroke length changes are made easily and quickly. Wrist pins are cut from alloy steel and taper fitted to the crank.

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Combination Upset and Plain Thread Pumping and Flowing Tee

To meet the special requirements of the oil industry, Hercules offers both Regular Combination Thread Pumping Tees and Cross Tees. All are made of malleable iron in sizes to meet your requirements and are tested to 3,000 pounds.

Has both upset and plain threads in the bottom end or tubing connection; a line pipe thread in the side outlet with plain tubing thread in top connection and a 1" line pipe thread opening on back side for bleeder valve or pressure gauge. Made for 2", 2½", and 3", plain or upset tubing. All 2" Tees have a 2" side outlet; all 2½" and 3" Tees have 3" side outlet.

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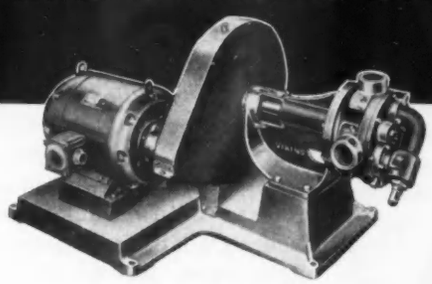

Viking Pumps are old reliable friends in the Oil Industry . . . and Southern Engine & Pump Company engineers are regularly utilizing their versatility and dependability in units for every service. Whatever your special requirement—they'll be glad to help you.

Pictured above: Gear drive unit includes gearing totally enclosed in sheet metal guard. Size and type of gearing as well as outboard bearing support depends on the size and speed of power unit needed.

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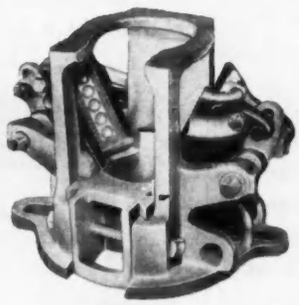

(Pat. Pend.)

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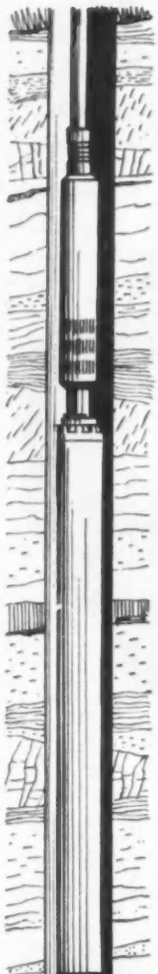

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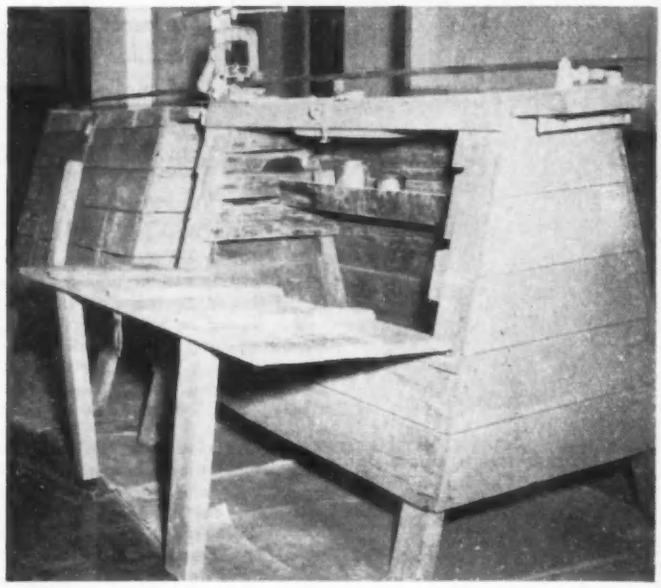
BARTLESVILLE, OKLAHOMA

Boxed Sawhorse Provides Tool Space



Where space is at a premium in the tool house, a space for storing small tools may be made between the legs of the horse on which the vice is mounted. This keeps everything necessary for doing piping work on the lease in one place where the tools may be kept locked up when not in use.

The tool box is made simply by boxing up the legs of ordinary saw horses with the front section hinged so that a working platform folds out when the tool box is opened. Legs for the platforms are made by taking two-by-fours and hinging them at the top so that they swing out and rest on the floor when the tool boxes are opened.

The tool boxes are small enough that they may be taken to various jobs, or kept in the main lease tool house. Sliding trays are built in the top part of the tool box, with the bottom made into a bin to keep the larger hand tools. When the roustabout or mechanic comes on the job, it is only necessary to unlock the panels, fold them out and reach into the compartments and get the tools necessary to work on the unfolded aprons or on the vise mounted on the top.

Build Pumping Unit Ladder From Scrap Rig Materials

In many areas safety regulatory authorities are requiring that operators equip each of their pumping units with a ladder permitting access to the saddle bearing from ground level. Most units sold now come equipped with such ladders, but on those units which were not, the operator is faced with a problem of either buying a ladder, or having one made.

One company found that a strong, neat appearing ladder could be built with little welding or fabrication by using salvaged rig ladder sections. One such installation is shown in the accompanying photograph. The ladder section of desired length was bolted to brackets attacked to the skid base members and to the apex of the A-frame of the sampson post. A handrail and safety ring at the top of the ladder were made of small pipe or sucker rod material.

Simplicity of this installation lends itself to quantity production in the company shops wherever a series of similar-sized pumping units must be equipped with ladders. Ordinarily such salvaged rig material is heavily galvanized and therefore needs no painting. It represents an economical and practical solution to the problem of equipping old units with ladders.

Second Major Cuban Oil Discovery Is Brought In

Cuban-Canadian Petroleum Company's Echevarria 3 well in Jatibonico area flows in open pits at estimated rate of 25-50 barrels an hour.

CUBAN-CANADIAN Petroleum Company of Cuba, wholly-owned subsidiary of American-Leduc Petroleum Company, Ltd., of Edmonton, Alberta, Canada, reportedly struck oil recently when it tested its Echevarria 3 well in the Jatibonico area of Camaguey Province. The well is 400 yards southwest of the original discovery well, Corporacion General de Petroleo, S. A. Echevarria 1 (see WORLD OIL July, 1954, Page 220) which brought in the first black oil from source beds in Cuba.

Although production tanks had not yet been erected for the test, the Cuban-Canadian Echevarria 3 (not to be confused with the Corporacion General de Petroleo Echevarria wells) was allowed to flow into open pits at an estimated rate of 25 to 50 barrels of 15-16 degree gravity crude per hour. This well is expected to flow more than 600 barrels per day.

Production comes from the open hole below 5½-inch casing set at 1400 feet, with total depth at 1440 feet. The well was spudded on Jan. 2, 1955, and surface casing set the following day. The first blowout occurred while drilling below 1359 feet. Before the well was killed January 28, with 11.6-pound mud, the well flowed a stream of oil 10 inches above the rotary table. After 5½-inch casing had been set, the well was drilled ahead, and it blew out a second time, and was killed with 11.5-pound mud. A bridge plug was set in the casing by the rotary rig which drilled the well. A cable tool rig was brought in the latter part of January to complete the well.

The bridge plug was drilled on February 3 and the well tested by flowing into pits. A number of U. S. oil men were present at this test, including Paul Benedum, well-known wildcatter from Pittsburgh, Penn.

First Producer. This is the first producer for Cuban-Canadian and a significant oil well for Cuba. The company has drilled and cased two additional wells that are yet to be completed by cable tools, and the rotary rig is currently drilling the company's Echevarria 4, in which 144 feet of surface casing was set February 3.

Echevarria 2 is next scheduled for completion by the cable tool rig. An electric log was run to 2483 feet (no log was run on Echevarria 3 due to blowout difficulties), and eight potential zones are expected down to total depth of 2400 feet. A total of 200 feet of net pay is forecast for the Well 2. This well will be perforated above 1400 feet, and its completion has been delayed due to the shipment of perforating equipment from the U. S. After Echevarria 2 has been completed, the company will go back into Well 1 for a completion. By then, Well 4 should be ready for a completion by the cable tool rig.

Cuban-Canadian let a drilling contract to C. J. Simpson Drilling Company of Dallas and Olean, N. Y. J. E. Wagstass is production superintendent of the drilling company which brought a rotary rig from New Castle, Wyo., for the Cuban operation. A ten-man American crew accompanied the rig.

Crude oil from the Jatibonico area will be purchased at a reported price of $1.87 per barrel at the well, and is said to be going to the Standard Oil Company of New Jersey, which operates a small refinery in Havana.

American-Leduc acquired 50 percent interest on a checkerboard basis in the Echevarria field from Petroleria Jatibonico, original grantees of the concession in Camaguey Province. This 50 percent interest represents a total of 15,000 acres. The Cuban-Canadian acreage offsets 15,000 acres purchased earlier by Corporacion General de Petroleo, S. A. in which Kerr-McGee Oil Industries of Tulsa has a 25 percent interest. Dr. Antonio Iglesias de la Torre is head of Corporacion General de Petroleo, and the original discovery well last year was drilled by a Cuban government-purchased rig with Kerr-McGee personnel.

Other significant wells. In the old Bacuranao area of Havana Province, and just east of Havana, the Solamon-Maxzidal group completed its Cruz-Zerde 1 well for an intermittent flow of 150 to 200 barrels of 29 gravity oil per day. The well came in Jan. 21, 1955. Total depth is 1055 feet, and the well produces from the open hole, below 10-inch casing which had been set at 606 feet. Operators plan to deepen the well.

Distillation analysis shows the oil from this well produces 28 percent of 64-octane gasoline, 12 percent kerosine, 30 percent gas oil and 30 percent bottoms and residuals. Base sediment and water amount to 0.05 percent and sulphur content is only 0.9 percent. The oil is being shipped to the Cabaiguan refinery near Jatibonico, but will be taken by the Standard Oil Company refinery at Havana.

Across the bay from Havana, Ted Jones Drilling Company of Cuba, has experienced four gas flowouts in its Santa Maria del Mar 1 with gas pressures gauged up to 3000 pounds per square inch. The well was last reported drilling at 3230 feet; it has been cored, and an electrical log was run during the first week in February. Ted Jones, independent drilling contractor of California, has acquired 20,000 acres in Havana Province bordering the old Bacuranao oil field and located on the well known Havan-Matanzas anticline. —**The End**

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MACHINE AGE COMES TO EGYPT. Nomadic Bedouins and their camels pause in the Western Desert of Egypt to watch a seismograph crew drill a shot hole for Egyptian-American Oil Company.

New Developments Focus Attention on Egypt

Well brought in, wildcat test scheduled. Private capital operations, more favorable laws helping.

By DON KLIEWER, World Oil Staff

Two private capital oil company operations have drawn world oil attention again to Egypt—a new oil discovery well has been brought in to the east and a deep test is scheduled to be drilled on the west. Thus, this nation, whose shifting oil laws over the years have caused drilling operations to ebb and flow is bracketed by hope on the one side and fulfillment on the other.

The discovery well, Ballaein 1, was brought in during January by National Petroleum Company of Egypt with production of more than 2100 barrels daily from 40 feet of oil sand at 7300 feet. The well is on the southern tip of the Sinai peninsula 100 miles south of Suez and 15 miles south of the Wadi Feiran oil field.

In the spring of 1954, NPC, which is owned by Southern California Petroleum Corporation, International Petroleum Company of Egypt, and Swiss and Belgian interests, drilled a well—Wadi Feiran 2—in the Wadi Feiran field with a production potential of 1500 barrels a day.

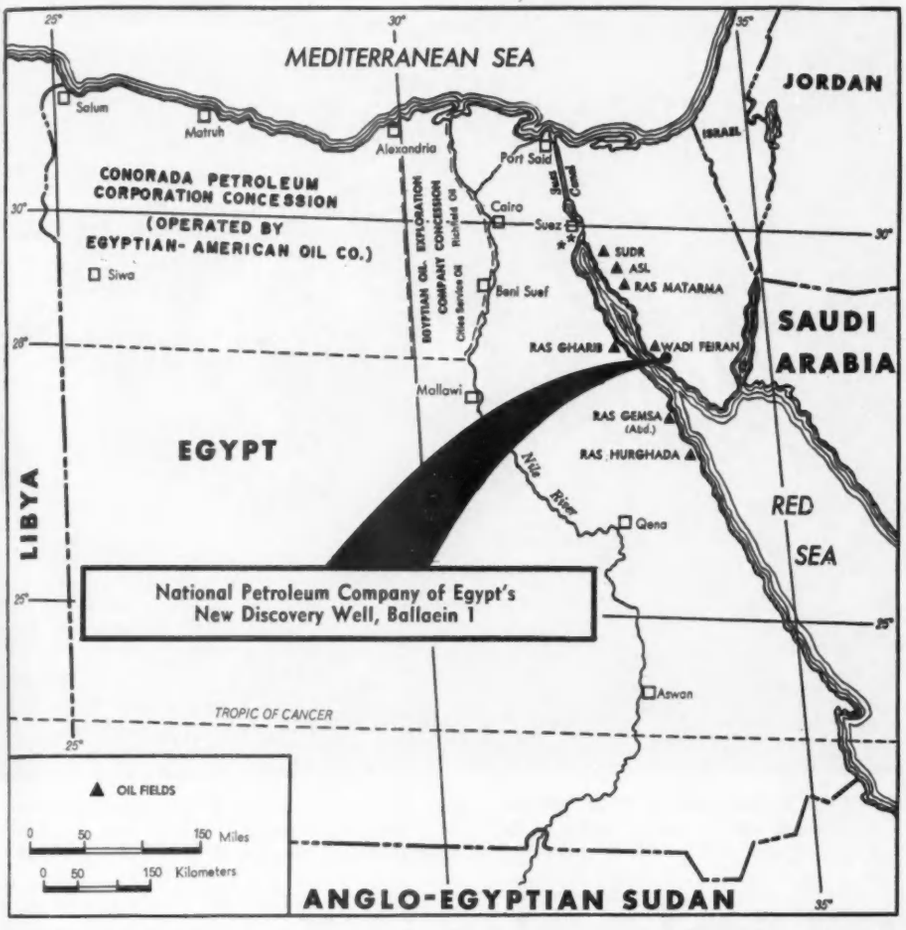
The deep exploratory test, scheduled to go to about 15,000 feet, will be spudded in by Egyptian-American Oil Company in March or April. It will be located about 60 miles from the supply receiving port of Alexandria and in the 75,000-square-mile concession recently granted by Egypt to Conorada Petroleum Corporation. Egyptian-American, a Continental Oil Company subsidiary, operates and manages the concession.

The test will be drilled with a rig purchased from Socony-Vacuum Oil Company, Inc., which had been stacked since Socony-Vacuum halted drilling operations in Egypt at the end of the first quarter of 1952. Drilling is expected to require a year.

This concession area has been undergoing extensive geophysical surveys by Seismograph Service Corporation, Tulsa, and Robert H. Ray Company, Houston. These exploration companies are conducting both seismic and gravity meter tests from base camps set up near Alexandria and Matruh (see map). Included in the materials and equipment sent to Egypt from Tulsa and Houston are:

- One hundred and seventy-five tons of explosives.
- Forty special seismograph trucks.
- Four camp trailers.
- Six rotary drills with maximum depth of more than 1000 feet each.
- More than 1700 geophones.

The exploration area stretches from Alexandria south about 200 miles and then west 350 miles to the Libyan



border. Contract terms of the concession include exploration rights in Egypt's tideland waters in the Mediterranean Sea.

Soon, the concession will be assigned to subsidiaries of Continental Oil, The Ohio Oil Company, Cities Service Company, and Richfield Oil Corporation.

Across Egypt, to the east, National Petroleum's Ballaein 1 and Wadi Feiran 2 are the initial productive results of recently renewed oil exploration in Egypt undertaken by several international companies since passage of a new mining law in 1953.

That new law removed one major restriction, and now foreign capital companies are accorded equal privileges with Egyptian companies in applying for production leases. Also, the provision in the Egyptian corporation law requiring foreign capital entities to offer 51 percent of their stock to Egyptian nationals has been modified.

The 1953 law, as its predecessor, offers no guarantee that the discoverer of oil on an exploration block will be given preference in application for a production lease on the discovery acreage. Exception to this is a provision in the law granting exploration-development concessions in the Western Desert to encourage development in that area. And that is where Egyptian-American is operating.

The concession which Egyptian-American currently is managing will run for 30 years, with a 30-year renewable clause under the same terms. The leased area is divided into about 440 blocks of 170 square miles each.

If oil production is developed, each block will carry an annual rental of $70,000. Under Egyptian law, Continental Oil, Ohio, Cities Service, and Richfield may be required to sell up to 20 percent of their share of the production to the government.

Another contract clause says Egyptians must be employed in exploration and oil development operations at a 75-25 ratio to outsiders. Total wages and salaries of national employes cannot be less than 65 percent of the combined payroll. More than 12,000 Egyptians applied for the handful of positions open with Egyptian-American.

Although commercial oil production has existed in Egypt only since 1910, current production is approximately 46,000 barrels daily, exclusive of the new National Petroleum discovery, from 150 wells in the fields near the Gulf of Suez (see map). Domestic output fails by a third of meeting the nation's domestic requirements, which currently are rising at a rate of 10 percent a year.

Except for Egyptian-American activities, the only exploration operations are in the Sinai peninsula. Recently, the government announced its plans to build a $5.8 million crude products pipe line from Suez to Cairo and its 2.5 million inhabitants.

Christian F. Dohm, Conorada president, and Fred Penniman, assistant manager in charge of government relations for Egyptian-American, did much of the preliminary work on the concession. Burney Braly, Continental Oil's assistant general counsel, spent six weeks in Cairo on contract details.

Others who figured in obtaining the concession were James J. Cosgrove, Continental Oil's chairman of the board; S. K. Clark, Continental's Foreign department manager; and Fred Funk, Ohio's Foreign department manager. A. A. Curtice, then president and now special representative for Conorada, was a pioneer in the concession negotiations. —**The End**

6 Companies Given Permits For Sicilian Exploration

The Sicilian Regional Government has granted the following new research permits for oil and gas in Sicily:

1. Società Estticiano—Milano, 104,950 acres between Enna and Caltanisetta in the region of Piazza Armerina.

2. Società "APE" of Genoa, 93,125 acres in the region of Segesta in the province of Trapani.

3. Società "Raffinerie Siciliane Olii Minerali" of Palermo, 76,800 acres in the region of Mascaluccia in the province of Catania.

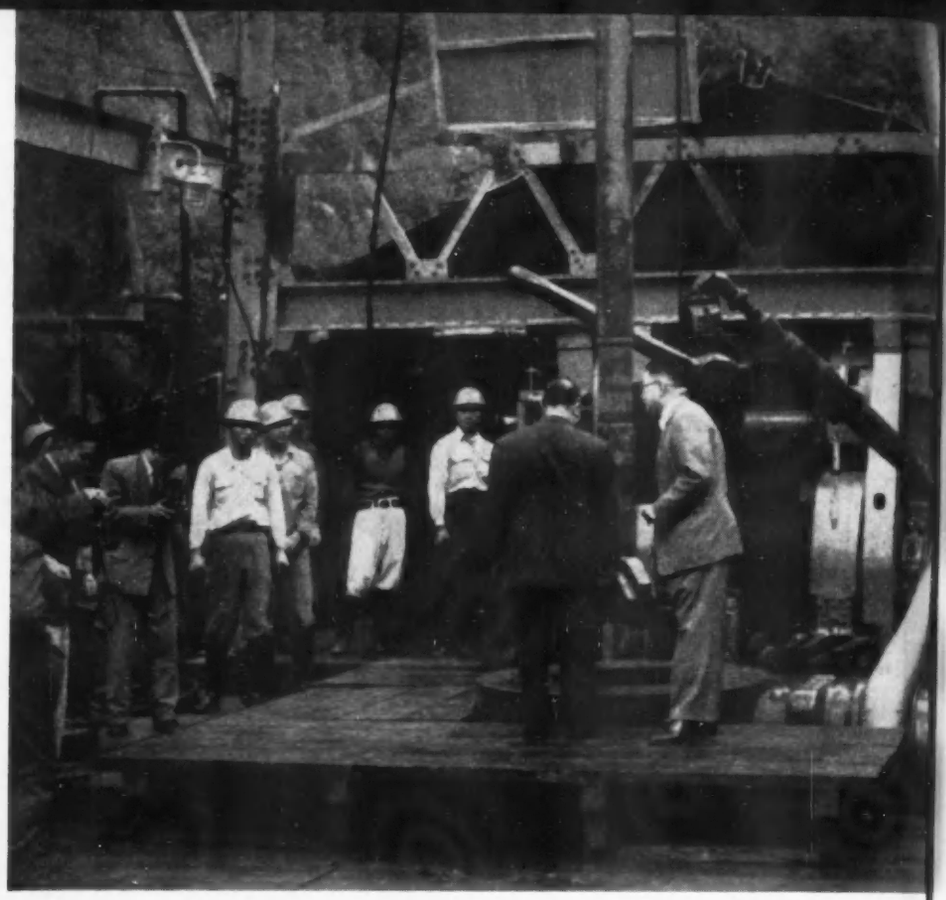
4. Società Emiliana Esercizi Elettrici of Parma, 86,375 acres in the region of Barrafranca in the provinces of Enna, Agrigento and Caltanisetta.

5. Società Industrie Chimiche Edison of Milano, 107,000 acres in the region of Trapani in Trapani province.

6. D'Arcy Exploration Company of London, 48,200 acres in the San Pietro region.

To develop this research further, geoseismic equipment and rotary drilling rigs will be ordered by Italian firms from American factories while negotiations are in progress to engage West German geologists and oil experts.

OVER-ALL VIEW of the diesel-powered drilling rig at the Shantzechiao location.



INSPECTION—Minister C. R. Hwang and K. Y. King, president of Chinese Petroleum Corporation, take a close look at the hole during spudding-in ceremonies for first wildcat of the 1955 drilling program at Shantzechiao, southwest of Taipei, Taiwan.

Oil Exploration in Taiwan Is Facing a Decisive Year

An intensified drilling program is being aided by expanded geological, micropaleontological and seismic services.

By LEO W. STACH, United Nations Expert in Petroleum Geology to Government of China

THIS WILL be a decisive year in the long history of oil exploration in Taiwan (Formosa). Discovery of Taiwan's second commercially productive oil field early in 1954, a half century after the first oil field at Chuhuangkeng began to be developed, has stimulated development of a considerably expanded and diversified exploration program undertaken by the government-owned Chinese Petroleum Corporation during 1955.

The new program will include test drilling of several new areas selected after evaluation of results of geological surveys conducted over the past two years, new geological surveys in other prospective areas and seismic surveys of structures concealed beneath the coastal plain of southern Taiwan.

To make this intensified effort possible, CPC greatly expanded its geological department, set up a micropaleontological laboratory, bought seismic equipment, and contracted for a seismic crew during 1954.

The United Nations Technical Assistance Administration has provided services of a petroleum geologist advisor to assist in planning and execution of the exploration program, and a micropaleontologist to organize and operate the laboratory and to train local staff. The U. S. Foreign Operations Administration is providing loans for purchase of drilling and oil field equipment and a petroleum geologist to assist with the program. American

Continued on Page 208

Opinions expressed here do not necessarily reflect those of the United Nations.

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DIGNITARIES OF GOVERNMENT, company representatives and visitors gather before Creole Petroleum Corporation's Conservation Plant Tia Juana No. 1 in the Coastal Bolivar fields for dedication ceremonies.

DR. EDMUNDO LUONGO CABELLO, director of Mines and Hydrocarbons for Venezuela, spoke on behalf of the Venezuelan government and officially dedicated the plant.

H. W. HAIGHT, president of Creole Petroleum Corporation, spoke about the plant and introduced Dr. Luongo.

Inauguration Sends Creole's Giant Compresssor Into Action

Station is largest of its type in the world; company will inject 137 Mmcf of gas daily into LL-370 reservoir in pressure maintenance program.

CREOLE PETROLEUM CORPORATION officially inaugurated its Tia Juana Conservation plant number 1 January 15, 1955. Located in the Tia Juana District of the Coastal Bolivar fields of Lake Maracaibo of Western Venezuela, this compressor station is the largest of its type in the world, and contains the first high-pressure centrifugal compressors ever put into service.

Purpose of the plant is to inject 137 Mmcf of gas daily into the LL-370 reservoir to maintain reservoir pressure. Gas is gathered at 10 pounds and compressed to 2000 pounds for injection into seven wells.

There are 47 producing wells in this particular reservoir, and the pressure maintenance project is the largest of its kind outside the U.S. By maintaining bottom-hole pressure, producing rates from the reservoir will be doubled, and ultimate recovery of oil will be increased by a third.

Dignitaries of the Venezuelan government, officials of Creole, representatives of the Venezuelan and U. S. press, oil men from both countries, and others concerned with the project attended inauguration ceremonies. H. W. Haight, Creole president, speaking in Spanish, provided background information on the project, and introduced Dr. Edmundo Luongo Cabello, director of Mines and Hydrocarbons for Venezuela, the main speaker.

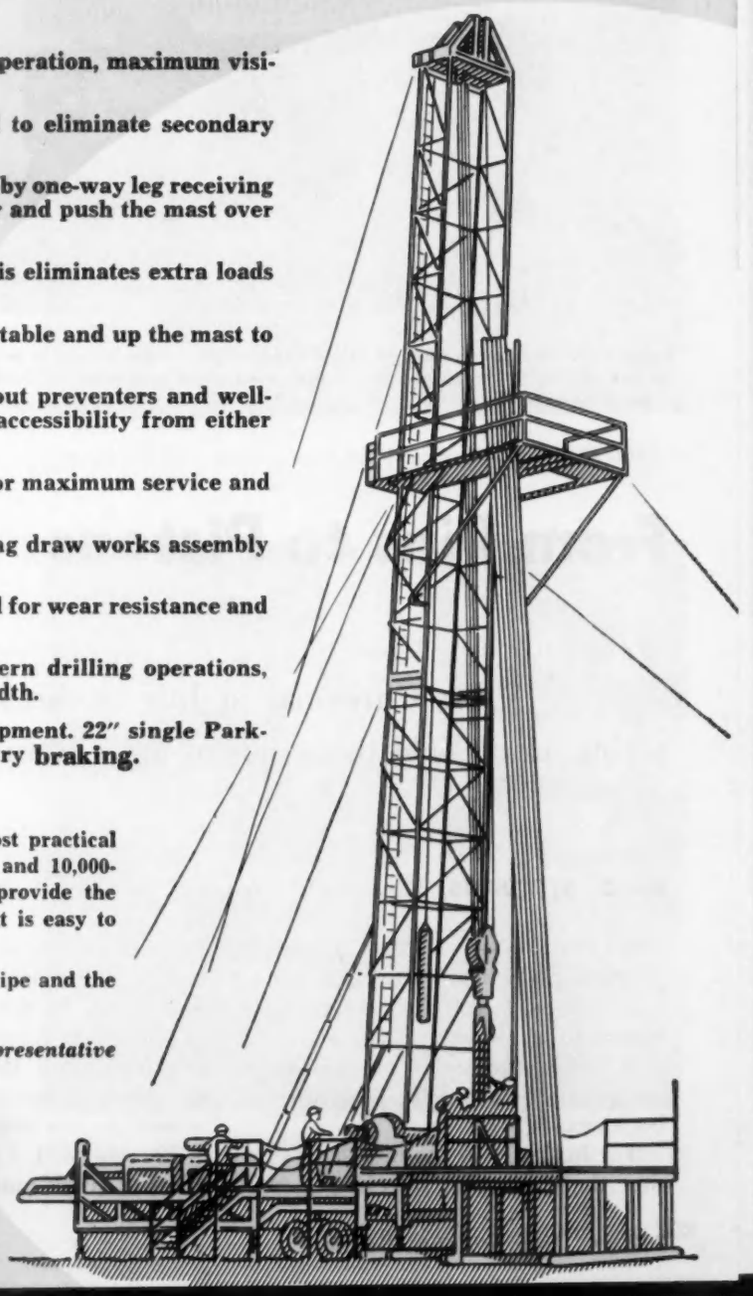
In reviewing the government's position toward conservation, Dr. Luongo said, "Cognizant of its responsibilities in the exercise of administrative power, the government, in effect, imposes on those who drill for oil in Venezuela the obligation of doing it by use of ways and means that will lead to the maximum ultimate recovery and the elimination of the physical and economic waste of gas and oil, above and below the earth's surface. Creole Petroleum Corporation deserves applause for the cooperation proffered Venezuela in building this plant, which has been baptized Conservation Plant Tia Juana No. 1. It is with joy that I now formally declare it inaugurated."

CARDWELL "TRAILERIG"

IS 15 WAYS BETTER

...than any comparable rig

1. **Mud Pump Drive is driven by draw work's engines through a Cardwell air friction clutch, which is capable of handling the full horsepower of the rig. Full horsepower of the rig can be used for hoisting and for driving the rotary and pump when drilling. Moving and rigging up is simplified with this built-in mud pump drive.**
2. **"Trailerig" with two engines is within eight feet road width for maximum portability regardless of the overall length of the engines. Placement of engines eliminates eccentric loading and engine overhang.**
3. **Truss-type trailer frame gives exceptional strength and rigidity with minimum weight.**
4. **All rig assemblies are easily accessible.**
5. **Catheads are located ahead of driller for ease of operation, maximum visibility and safety.**
6. **Single chain rotary drive is placed well forward to eliminate secondary chain drives to table.**
7. **One-way rams erect the mast and are supplemented by one-way leg receiving rams which support the mast as it goes over center and push the mast over center when lowering.**
8. **No trailer ramp is needed with the "Trailerig"; this eliminates extra loads and rig-up time.**
9. **Driller has maximum visibility, both to the rotary table and up the mast to the racking platform and crown.**
10. **Ample space is provided under platform for blowout preventers and wellhead connections without using ramps. Complete accessibility from either side.**
11. **Crown sheaves are mounted on Timken bearings for maximum service and life.**
12. **"Trailerig" is a completely unified design combining draw works assembly and telescoping mast with trailer frame.**
13. **Every wearing part of the "Trailerig" is heat-treated for wear resistance and long service life.**
14. **Two-engine drive gives power necessary for modern drilling operations, yet the "Trailerig" does not exceed 8-foot road width.**
15. **Circulating water-cooled brakes are standard equipment. 22" single Parkersburg Hydromatic brake is available for auxiliary braking.**



This Cardwell "Trailerig" has proved to be the most practical and profitable rig available for 5,000-foot drilling and 10,000-foot workover jobs. It is designed and built to provide the modern drilling contractor with a complete rig that is easy to move and rig-up, and fast in operation.

With the addition of a mud pump, a string of pipe and the usual tools, the "Trailerig" is ready to drill.

Write today for catalog and prices, or see nearest Cardwell representative

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P. O. Drawer 2001 . . . Long Distance Telephones 128—129—130
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Kuwait Oil Company's Kuwait store rivals many larger stores in more populated sections of the globe. It stocks almost 10,000 items and provides oil field workers almost any item they need . . .

From Pins to Pistons

It's Christmas in July at this warehouse supplying an oil field thousands of miles from home base.

By D. S. CURTIS, Kuwait Oil Company, Kuwait, Arabia

SUPPLYING AN oil field thousands of miles from home base is a herculean task and bears a strong resemblance to a military operation.

It takes big doses of teamwork, imagination, foresight, monumental bookkeeping.

For instance, in the middle of summer the competent storekeeper must prepare for Christmas, since he knows it will take months to get his Christmas stock. In winter, he must think of those air conditioning units and not wait until the scorching sun of the Arabian desert makes life an oven —without air conditioning.

Kuwait Oil Company's store at Kuwait rivals many large institutions in more poplated sections of the globe. It stocks upwards of 100,000 items, from pins to pistons, from chair seats to valve seats, from bathroom taps to valves, from cricket balls to crankshafts.

Responsibility for supplying the needs of one of the world's major oil fields located in the heart of the Arabian desert rests with the Supplies Division in London and the Stores Department in Kuwait. They've done a magnificent job in making Kuwait Oil Company self-supporting.

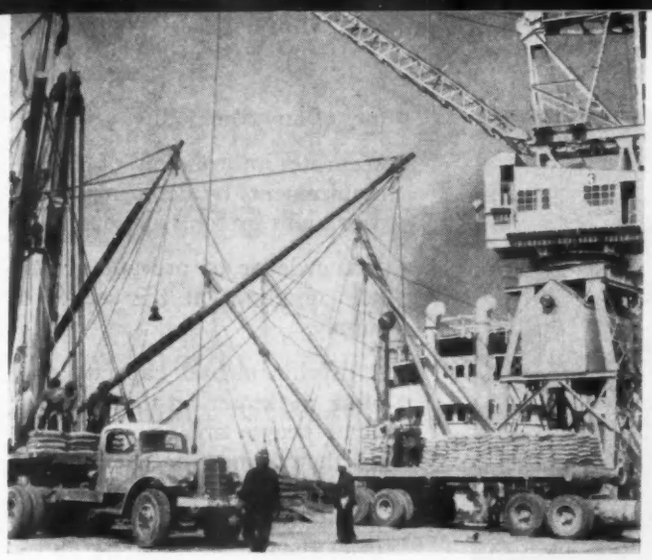
Problems faced by all phases of operations in the building of the Kuwait Oil Company in Kuwait are correlated in every aspect of the world today—restrictions, shortages, manpower, equipment, postwar lethargies, financial regulations, delays, breakages, pilferages, and so on. Indeed, the story of the Stores Department and the part it has played in the operation of the Kuwait Oil Company is a worthy one.

The supply organization is responsible for the purchasing, shipping and handling in Kuwait of everything used in company activities. The function of the London end, known as the Purchase and Supply Branch, is to receive demands, invite tenders, place orders and ship the material. The Kuwait end receives, stores and issues materials, and produces indents for future requirements in sufficient time for their use.

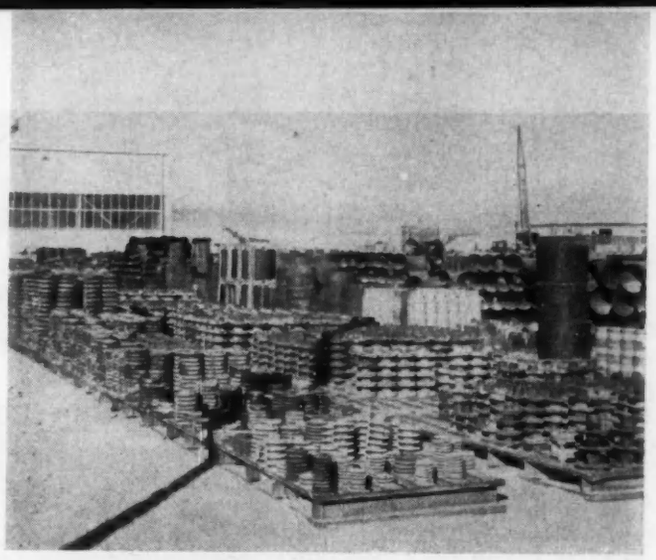
The Kuwait store has upwards of 100,000 items on its "shelves." Some items can be counted on the fingers as units; some are measured by the ton, or gallon, dozen, cubic centimeter or square yard—in fact by every known unit of measurement. plus a few more.

Setting up the store was a major problem in itself. Confronted with the wide variety of items, the problem was to devise a system where every given article could be quickly located. The system had to satisfy three groups—consumer, storekeeper and accountant.

Ranging the "merchandise" alphabetically on long shelves was impractical. It would be difficult to have drums of grease, gas stoves, gaskets, glue and glass side by side on the shelf and on another batteries and bedsteads, bathtubs and bitumen. Nomenclature presented a formidable obstacle, since no two men may desig-



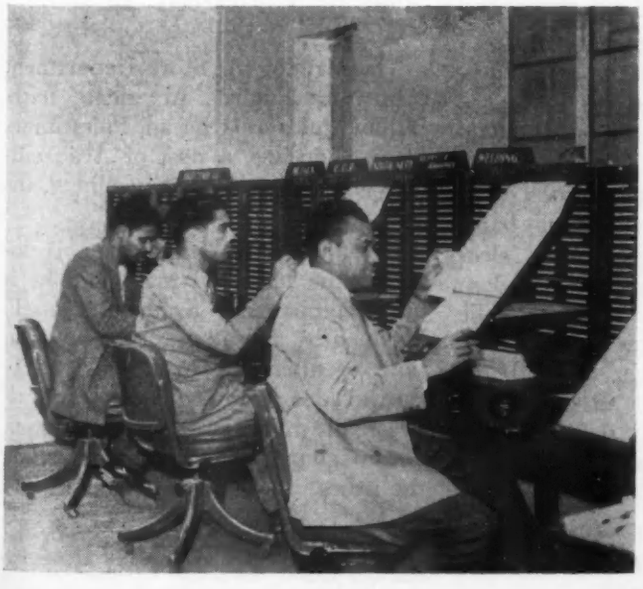
PORT OF ENTRY at Mina-al-Ahmadi, where the nearly 10,000 items stocked by the Kuwait store are unloaded.



VALVES AND FITTINGS section of the Kuwait store. Items are stored according to classification.

NATIVE WORKERS present requisitions for general stores at this counter.

SPARE PARTS section contains a maze of items to be used by the Kuwait employes.



POSTING CLERKS in Central Posting section keep continuing records.

MATTRESSES, STEW POTS and garbage cans are among items in Outfits section.

COUNTLESS FORMS, blanks, etc., are found in the Stationery section of Kuwait Oil Company's store in Kuwait.

nate a single object by the same name in all instances.

A building engineer may ask for "H" beams, another for "I" beams; either way, they actually mean rolled steel joists. One may ask for a "stub axle" the other for a "half shaft." One man at the Welding Section counter asks for "electrodes," the next for "welding rods," the third for "welding wire." All are after the same thing.

The most efficient classification for the stores combines several elements and is essentially a functional arrangement. Thus, if the function of an article is connected with pipe fitting, it is in the Valves and Pipe Fitting store where it is available to pipe line, production or engineering departments. The contents of the Stationery store are all functionally in the same class. Spare parts for machines are required by various sections of the Engineering department, Marine department, pipe line or production, but all are assembled in Plant Spares.

For convenience, a Vocabulary of Stores was set up to index and catalog all items. In addition, this procedure lays down a vocabulary number for every item which identifies that item with every aspect of the work to the storekeeper, the record clerk, stores accountant, and to the purchaser in London and New York.

The setting up and maintaining of the vocabulary may be likened to an enormous jig-saw puzzle, where every item represents one piece. Some pieces fit easily. Nobody would put fuse wire anywhere but in Electrical Stores, but what about an electric cooker? It is a piece of electrical equipment, but it is also a piece of kitchen equipment.

Stock on Move. Every item of stock is on the move. Physically, the movement starts from a factory in the U. S. or the United Kingdom, from there to the docks, to the ship, and thence to the port of Mina. On the road through the Receiving Section and into the appropriate stores section.

No two of the 100,000 items are moving at the same speed. The "bread and butter" items move quickly. Nails, oils and greases, cups and saucers, fan belts, gaskets, hammers, pencils, small pipe fittings, electric light bulbs—these are random items always on the move. While some are passing over the counter, more are arriving over the jetty or lighter quay, by train to some English port and out of the manufacturers' packing departments. There must be no interruption.

Anticipating future demands is a major responsibility and is based on four major requirements:

- Accurate statistics of previous uses of any commodity.
- Accurate information of future requirements by departments for operations or construction.
- A knowledge of prevailing market conditions at the source of supply.
- A psychic mental capacity enabling the storeman to know how other people are going to make up their minds, or change their minds, before they have done so themselves in, say, nine months from then.

An important part of the Kuwait supply system is the Traffic Division. It handles all imports and exports by air, land or sea, internal transfers, and returned materials together with all the documentation. Cargo ships discharge and stevedoring in general is a skilled trade and a thorough knowledge of this work is needed. A modicum of maritime law and all matters concerned with bills of lading, manifests, claims, out-turn reports, etc., must be dealt with competently.

Every piece of material or vehicle received by the company has to be tallied and checked, invoices cleared, claims, shortages, damages or loss recorded or raised and insurance matters settled. All is the responsibility of the Traffic Division.

Since 1947 the Stores Department has imported nearly 500,000 tons of material valued at £30 million (about $84 million). The peak tonnage year was 1948 when the company imported almost 200,000 tons valued at £13,300,000 (about $37,300,000).

The staff of the Store Department consists of English, American, Irish, Indian, Pakistani, Syrian, Palestinian, Iraqis, Persians, a host of Arab citizens and nationals of the country, the Kuwaitiis.

Nowadays, the storekeeper is assisting the technical man, and he is quite competently technical himself. Frequently, he advises on substitutions or alternatives and has a very shrewd idea as to the correct quantities really required by the consumer. He safeguards his stock by controlling the issues. **—The End**

ACKNOWLEDGMENT

Excerpted from a paper presented at the Persian Gulf Branch, Institute of Petroleum, Ahmadi, Kuwait. Photos courtesy Kuwait Oil Company. The author wishes to thank the Institute of Petroleum for permission to present this excerpt to WORLD OIL.

British Petroleum Company—A Name Change and Rebirth

Formerly called Anglo-Iranian Oil Company, the world-wide organization has recovered significantly from Iranian nationalization action.

By **ROBERT E. SPANN,** WORLD OIL Staff

THE CHANGE from Anglo-Iranian Oil Company to The British Petroleum Company at the end of last year meant more than just a change in corporate name. It signified the successful rebirth of an oil company which lost a major asset only three years previously.

Recovery from the serious blow suffered by the nationalization of the company's properties in Iran in the fall of 1951 has been remarkable. British Petroleum's crude oil production last year, including its share of affiliated company operations, averaged about 661,200 barrels daily, or approximately the same volume the company produced in Iran in the last full year of operation in 1950. Production last year was only 36,000 barrels daily under the company's 1951 world total, when its operations in Iran for the full year were substantially reduced.

Nationalization of the Iranian properties came just 50 years after the original concession had been granted and 42 years after the original Anglo-Persian Oil Company was formed. Crude oil production had been built up to an average of 661,400 barrels daily by 1951, and at times had exceeded 700,000 barrels daily. The largest refinery in the world had been erected at Abadan with a rated capacity of 500,000 barrels per day. A 1000-mile pipe line network had been constructed connecting the oil fields to the refinery and shipping terminals. In the agreement signed last fall between Iran and the eight-company consortium that is now operating the Iranian industry, the Iranian oil properties were given a book value of $1 billion.

Capital expenditures by The British Petroleum Company have been stepped up considerably in the three years since the Iranian nationalization and the total invested in producing, refining and distributing facilities around the world (including partly-owned companies) amounts to $535 million. British Petroleum's profits in the past three years reflect the aggressiveness of the company in recouping its position as one of the world's seven largest oil companies. While financial results for 1954 are not available yet, the company had a net profit of about $68.4 million in 1953 and $70.5 million in 1952. Though these figures are below the $92.6 million earned by the company in 1950, they are ahead of the net income in 1949 and about equal to 1948 earnings.

Recovery of the company's position in petroleum refining has not matched the performance of the producing branch. In addition to the capacity at Abadan, the company had 295,000 barrels daily in refining capacity in 1951, including its share of partially-owned affiliated companies. By the end of last year, British Petroleum's refining capacity in the United Kingdom, Europe, the Middle East, and Australia had grown to 476,000 barrels daily. In addition, a new refinery of 63,000 barrels daily capacity was nearing completion in Australia and expansion and modernization programs were under way elsewhere. While this is less than the 1951 capacity owned by the company, it represents a major stride to recover its position.

British Petroleum's tanker ownership by the end of last year totaled 153 vessels of 2,063,000 deadweight tons, many of which have been constructed recently. This compares with a fleet of 155 vessels totaling 1,950,000 deadweight tons three years earlier. Additional tanker tonnage is under construction and the company also charters a large number of tankers.

British Petroleum's comeback in crude production after the loss in Iran results from its long-standing investments in two other Middle East producing companies—Iraq Petroleum Company, which produces in Iraq and Qatar, and Kuwait Oil Company, which owns the concession in the skeikhdom of Kuwait. The latter concession is jointly owned with the U. S. Gulf Oil Corporation, and Kuwait production was increased sharply after the Iranian nationalization, rising from 345,000 barrels per day in 1951 to 952,252 barrels per day last year.

The company's interest in Iraq Petroleum and affiliated companies is 23.75 percent and British Petroleum's share of IPC production increased from 32,881 barrels daily in 1950 to 171,610 barrels per day in 1954. Also in Iraq, BPC has output from a wholly-owned subsidiary, Khanaqin Oil Company, which now averages about 10,900 barrels per day.

Crude production from these interests can be expected to show further gains in 1955, and, in addition, British Petroleum will have crude output from its 40 percent interest in the eight-company consortium now operating the Iranian producing and refining industry. Based on the presently scheduled output for 1955, British Petroleum's share would amount to about 120,000 barrels daily. The Abadan refinery is scheduled to operate at about 200,000 barrels daily.

British Petroleum also has extensive exploration activities in nine countries, which, in some cases, are jointly operated with other companies. Offshore operations are being conducted in the Persian Gulf and off the coast of Trinidad where BPC is a one-third partner. Jointly with the Royal Dutch/Shell Group, BPC has exploration programs in several areas in Africa, including a new wildcat on Mafia Island off the coast of Tanganyika, four wells being drilled in southern Nigeria; and geophysical work in Zanzibar.

In eastern New Guinea, the company is a partner with Standard-Vacuum Oil Company and Australian interests with two wells being drilled near Omati. Also a new program with partners is underway in Australia. The company made a discovery of heavy crude near Vittoria, Sicily, last year and is continuing the search. Recently, it entered Canada with a 50 percent interest in Triad Oil Company. It also produces crude oil and shale-derived crude in the U. K.

The company's worldwide market-

ing has been expended particularly with the increase resulting from the purchase of Atlantic Refining Company's outlets in Europe and Africa.

British Petroleum Company's start can be attributed largely to the dreams of two men. One was William Knox D'Arcy, an Englishman who on returning home after making his fortune in Australia, became interested in the oil possibilities of Persia, as Iran was then called. A report of a French archaeologist on the country impressed him and he succeeded in getting a 60-year concession to search for oil in 1901.

Drilling started the next year and after a few unsuccessful years, Burmah Oil Company took over the operation. Oil was discovered in 1908 and Anglo-Persian Oil Company (the predecessor to AIOC) was formed in 1909. Burmah Oil still holds a 24 percent stock interest in the present British Petroleum.

The other individual responsible for the start of Anglo-Persian was a British naval officer, Admiral Fisher, who had long dreamed of converting the British navy from coal to oil. His pleas fell on deaf ears for years, but the discovery and development of substantial reserves in Persia and the threat of World War I helped the admiral's case. The then First Lord of the British Admiralty, Winston Churchill, finally approved the switch. The British Government signed a long-term fuel oil contract with Anglo-Persian and bought an interest in the company—today the ownership amounts to nearly 54 percent—and Anglo-Persian had its start to become one of the world's major companies.

The company's headquarters are in Britannic House, London, and its board of directors consists of Sir William Fraser, chairman; B. R. Jackson, deputy chairman; W. E. V. Abraham; E. H. O. Elkington; N. A. Gass; F. E. Harmer; Sir Kenneth Harper; W. J. Keswick; Sir Gordon Munro; J. M. Pattinson, and D. Abel Smith. Sir William Fraser, B. R. Jackson, E. H. O. Elkington, N. A. Gass and J. M. Pattinson are managing directors and, until last year, H. E. Snow was a managing director. Snow resigned in 1954 to become general manager of Iranian Oil Participants, the holding company representing the eight-company consortium to produce Iran's oil. Two members of the 12-man board are appointed by the British Government. —**The End**

Decisive Year in Taiwan

Continued from Page 198

Overseas Petroleum (a Caltex subsidiary) expressed some interest in entering the exploration field in Taiwan during 1954.

Yield from the first two wells completed for production on the newly-discovered small south culmination of the large Chutauchi structure was sufficient alone to make 1954's production of crude practically double that of the preceding year and to raise the total annual production of about 35,000 barrels to its highest level in 14 years. With only the one-rig development drilling program scheduled for this new field during 1955, total production of at least 50,000 barrels in 1955 seems to be assured. Particularly with the possibility of more production that may result from discoveries in the new areas to be test drilled during the year.

Apart from two wildcats drilled on gravity anomalies about six years ago, the few test wells drilled since that time have been restricted to cautious feeling out in the vicinity of known productive structures. Evaluation during the past year of results of more intensive geological surveys initiated in 1952 has enabled the selection of several new areas for test drilling to be made.

An early start for the program is assured. The first wildcat of the series, located on the Shantzechiao structure in northern Taiwan about 12 miles southwest of Taipei, was spudded in on Christmas Day. It will test potential target zones in the lowest known part of the Miocene.

Another wildcat location now is being prepared to test the south end of the west flank culmination of the Chutauchi structure closed against the axial thrust fault. Wildcat locations in other areas are more difficult of access, but plans for road construction are well advanced.

Seismic equipment and a shothole rig arrived in Taiwan in November of last year. Contract seismic crew from the Teikoku Oil Company arrived from Tokyo, Japan, late in December. Thus, an immediate start was scheduled at the beginning of this year on the two projects in the coastal plain area of southern Taiwan selected from data gleaned from CPC gravity surveys conducted in 1946-1947.

—**The End**

Russia Moves Baku Petroleum in 3 Stages

Russia is using three stages of water transportation to move oil from the Baku producing area to important inland cities such as Moscow, Gorky, Kazan, Saratov, and Stalingrad.

First stage is covered by large tankers operating through the Caspian Sea from the port of Baku to the Astrakhan sea roadstead off the mouth of the Volga River. Several of these northbound tanker departures are made daily, according to the Soviet press.

The tankers are forced to transfer their cargo to "roadster barges" well out to sea because the northern Caspian is shallow, and heavily laden ships cannot negotiate the Volga delta channels. Trans-shipment of oil from the tankers to the barges reportedly is accomplished "in a few hours," to free tankers for the return trip to Baku.

Tugs tow the barges to the Volga River roadstead, where the oil is pumped into storage facilities at shore bases. The barge caravans, which sometimes are more than one-half mile long, including the tug, can each make about 10 roundtrips monthly across the Volga shoals to the river roadstead.

Progress of the caravans is watched, supervised and facilitated by guide and supply ships along the route. Fuel, food, mail, and even medical attention are provided for barge and tug crews while the caravan is in motion.

Third and longest stage begins with the loading of river barges at the Astrakhan shore bases. The barges are towed up the Volga and its branches in groups of three to five.

Scores of small, self-propelled tankers also ply the Volga and its tributaries to deliver fuel to minor storage bases which supply the agricultural regions directly.

Operation of the Volga oil transportation system is shut down four to five months each year when the river is frozen over. During this period, crews repair ships and barges. Ice breakers deliver the barges to the oil bases and loading begins in the spring well before the re-opening of normal navigation.

The men who run these companies are local men in the oil fields. They concentrate on serving a small area more effectively, rather than playing the big field and scattering their efforts. Because they are not run by remote control or bound by rules and tradition, they can make decisions and give answers on the spot quickly. They depend for their livelihood on making the right decisions and having the right answers.

This ability to make decisions fast begins with the suppliers' salesmen and store managers who have lived for many years in day-in-and-day-out contact with the oil men. They often live in their stores, offering 24-hour service on even the smallest items of equipment. They know their customers, know their problems and work with them in a sort of partnership.

"Often drilling contractors and producers hate the smell of ink. We do business with them so they don't have to smell ink," one independent says. If some unusual problem arises, the field store can get a decision from the home office within a few hours.

The owners and other top men for the independents are continually on the move visiting their customers' operations and keeping in touch with their activities and requirements. Their roots go deep in the oil fields.

• **Free Selection**—The independent distributor has an advantage in the range and variety of products he carries for the oil men. Because he is independent, he can select from nearly the entire field of manufacturers and deal with those firms he knows will provide the best in quality and service.

Today, with seamless tubular goods in easier supply, oil men who have become more cost-conscious are depending more on the local distributors because they know they are operating with less overhead. This means continued personal service at prices that are competitive.

• **How Quality Counts**—For nearly a half century, Pittsburgh Steel Company has been supplying the independents with most of the drill pipe, casing, and tubing produced at its Allenport, Pa., tube mills. Over these years it has established a reputation for giving them the kind of quality they depend on for reliable service to their customers.

Pittsburgh Steel has worked closely with these distributors, although it has no financial interest in any of them. It deals fairly and without favoritism, working out problems on the same personal basis that the independents work on with their customers. Pittsburgh Steel can also make decisions fast, yet it is large enough to supply a wide range of seamless tubular products in important volume.

Today Pittsburgh seamless is distributed through 19 independent suppliers who operate a total of 141 stores in every major oil field in the country and some abroad. If you are a drilling contractor, a producer, an engineer, or purchasing agent for an oil company—why not get the pipe of your choice through the supplier of your choice? Next time you order seamless pipe, *specify Pittsburgh!*

For Fast, Personal Service

—these independent distributors who carry Pittsburgh Seamless drill pipe, oil well tubing, and casing are ready to meet your requirements.

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Home Office
130 Main Street
Bradford, Pennsylvania

Buckeye Supply Company
18 Harrison Street
Zanesville, Ohio

C. W. Cotton Supply Company
Utica National Bank Building
Tulsa 5, Oklahoma

Franklin Supply Company
624 South Michigan Avenue
Chicago 5, Illinois

Houston Oil Field Material Co.
1524 Maury Street
Houston, Texas

Industrial Supply Company
500 Eighth Street
Wichita Falls, Texas

Iverson Supply Company
400 West Fifth Street
Tulsa, Oklahoma

Lucey Export Corporation
233 Broadway
New York 7, New York

Lucey Products Corporation
624 South Cheyenne
Tulsa 19, Oklahoma

McJunkin Corporation
P. O. Box 513
Charleston 22, West Virginia

Midland Supply Company
Box 3105
Washington St. Station
Wichita 7, Kansas

Mountain Iron & Supply Co.
100 Rule Building
Wichita 2, Kansas

Murray Brooks, Incorporated
P. O. Box 855
Lake Charles, Louisiana

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Producers Supply & Tool Co.
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Fort Worth 2, Texas

Rodman Supply Company
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W. L. Childs, Jr.

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H. J. Schlarb

S. D. Beckley

R. V. McIntire

N. L. Boulden, Jr.

Gilbert Swift

R. C. Glover

Don L. Collins

JAMES D. HUGHES, Lane-Wells Company, senior regent from the Los Angeles Chapter of Nomads, has been elected chairman of the organization's National Board of Regents for 1955, and JOHN H. FLANAGAN, Johnston Testers, Inc., junior regent of the Los Angeles chapter, has been chosen secretary-treasurer of the National Board, HARRY E. ESTES, Oil Well Survey Instrument Company, national executive secretary and member of the Houston chapter, has announced.

New officers recently elected by the five Nomad chapters are:

Dallas-Fort Worth, Texas Chapter: CLIFFORD R. ATHY, Maxwell Steel Company, president; G. C. WALDROP, Oil States Rubber Company, senior regent; TED W. MAYBORN, Drilling magazine, junior regent.

Houston, Texas, Chapter: W. L. CHILDS, JR., Reed Roller Bit Company, president; E. M. FONTAINE, National Tank Company, senior regent; R. K. FRANKLIN, Rolo Manufacturing Company, junior regent.

Los Angeles, California, Chapter: H. J. SCHLARB, Chiksan Company, president; JAMES D. HUGHES, senior regent; JOHN H. FLANAGAN, junior regent.

New York City, Chapter: S. D. BECKLEY, Beckley, Haltom & Hickman, president; R. V. McINTIRE, Baker Oil Tools, Inc., senior regent; N. L. BOULDEN, JR., International General Electric Company, Inc., junior regent.

Tulsa, Okla., Chapter: GILBERT SWIFT, Well Surveys, Inc., president; R. C. GLOVER, Baker Oil Tools, Inc., senior regent; DON L. COLLINS, Republic Supply Company, junior regent.

•

IRA C. MAYFIELD has been elected president of Heiland Exploration Canada Limited, Calgary, Alberta. He formerly served as vice president.

Other newly-elected officers are JEROME L. BURNS, first vice president; GEORGE D. HOBSON, second vice president; and BRIAN F. SPOONER, secretary-treasurer.

•

MILTON S. BERINGER has been appointed president and chairman of the board of The British American Oil Company Limited, Toronto, Canada, succeeding OLE BERG, JR., who resigned. Beringer formerly was chairman of the board and director.

J. GERALD GODSOE, formerly vice president and director, was named executive vice president.

HTL announces the model 7000

. . . the most versatile seismic system available!

Designed to meet your specific requirements, the Houston Technical Laboratories' new Model 7000 provides the greatest versatility of any seismic system ever produced for commercial use. With an AGC control range of 1,000,000 to one, this compact and portable new HTL model is a high gain system (more than 120 decibels) ideally suited for magnetic recording and other special seismic applications.

The HTL Model 7000 gives you unchallenged superiority in distortion control and sensitivity with an input range from 0.1 microvolt to 0.1 volt between 10 and 200 cycles with less than 1% harmonic distortion. Unique filtering flexibility — 1380 filter combinations — plus advanced two-loop Automatic Gain Control add to the versatility of this new seismic system. AGC speed control on each channel provides a choice of three positions — slow, medium, or fast.

- 1,000,000 to 1 dynamic range
- input signals as low as 0.3 microvolt saturate AGC (AGC threshold 0.1 microvolt)
- 1380 possible filter combinations
- negligible distortion up to 0.1 volt input
- ideally suited for magnetic recording
- module construction for portable or vehicle use
- three AGC speed positions on each channel
- linear, time-varied gain, or AGC operation
- built-in complete testing facilities

WRITE for HTL Bulletin No. S-304 for more detailed information about this completely new development in seismic instrumentation. Model 7000 systems now in production and available.

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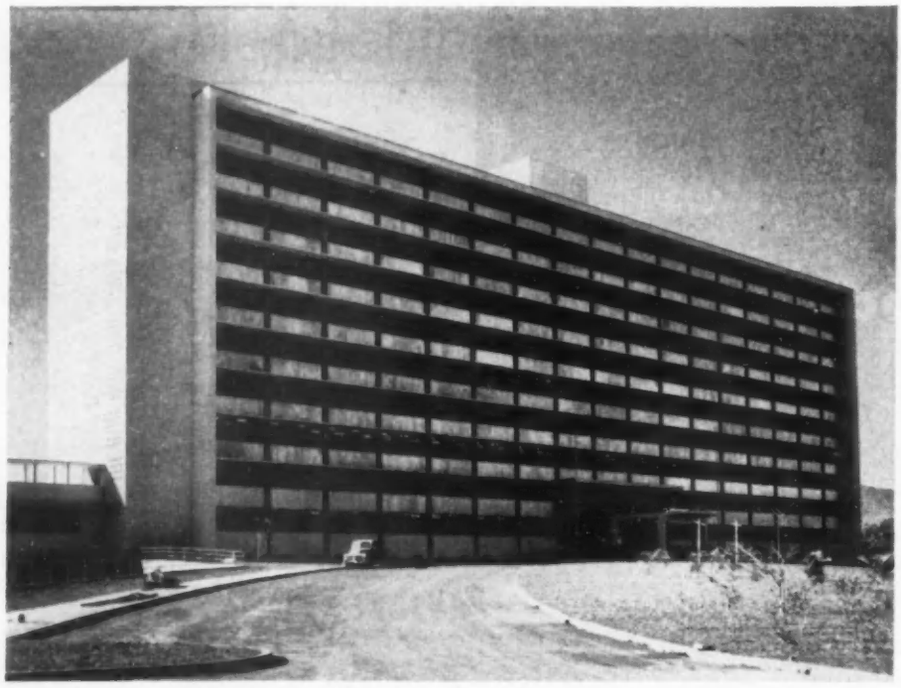


New $8 Million Creole Office Building in Caracas
This is Creole Petroleum Corporation's new $8 million, 10-story office building in Caracas, Venezuela, which will serve as the operations center for the company, the Venezuelan affiliate of Standard Oil Company (N. J.) and one of the major oil producing companies of the Western Hemisphere. Formal inauguration is scheduled for March 15. About 1400 employes will have office space in the building. Overhead fluorescent lighting fixtures are supported by recessed tracks in the ceiling so the fixtures may be moved when desired. With Caracas' mild climate, no airconditioning was needed for the building, except on the second floor of the annex which houses the battery of delicate electronic computers of the Accounting department.

Moscow Seeks To Develop Satellite Crude Exports

A Budapest message reports that Moscow has "invited" the Hungarian Department for Industry to reduce by one-half the Hungarian consumption of crude and crude products and to place the remainder of the nation's production at the disposal of a joint organization to be created by Russia in the Balkan countries to develop oil exports from Rumania, Hungary and Czechoslovakia.

The Red China government recently has purchased motor fuel in Rumania, and Chinese Air Force officers have arrived at Bucharest to study the possibility of transporting fuel by air from Rumania to Red China.

Deficit Between Output, Use Of Oil in Red Far East Cited

Further proof of a major deficit between production and use of petroleum products in Russia's Far East has been provided by L. M. Kaganovich, first vice president of the USSR Council of Ministers.

In a recent speech published by the official government newspaper Izvestia, Kaganovich said "the consistent lag in Far Eastern oil extraction requires expenditure of 1 billion rubles (about $250 million) annually for shipping petroleum products into the area." He also observed that "it would be infinitely more expedient to spend these transportation funds on accelerating the development of oil extraction in the Far East.

Russia Forges Another Link In Strategic Oil Planning

Shortly before Christmas, three directors of the Sovjustneft-Export arrived in Vienna, Austria, and took over the offices awaiting them since November. Their arrival and the establishment of a Sovjustneft-Export branch in Vienna is believed to be a further link in the incorporation of Austro-Soviet oil into the Soviet Union's strategic international oil sales plan.

During 1954, branch offices were set up in Egypt, France, Yugoslavia, and Great Britain. It is expected that Israel will be added to the list.

31-Barrel-a-Day Producer Brought in at Scheerhorn

Scheerhorn 80, drilled by C. Deilmann Bergbau GmbH. on behalf of the joint interest consisting of Deilmann-Elwerath-Preussag-Wintershall, has been surprisingly successful not only in the normal oil-bearing horizon of the field—the Bentheim sandstone —but also in the Gildehaus sandstone of the Hauterive (Lower Cretaceous).

The well, in the southwestern part of Scheerhorn field, is pumping 31 barrels a day from the Hauterive at 3552 feet-3583 feet. Bentheim sandstone was found at 3658 feet.

Black Swan Well Producing 18-Gravity Oil in Sicily

Well 1, known as "Black Swan," drilled by Petrosud Company in the Pescara Valley near Alanno in Sicily's Abruzzo region is producing 18-gravity crude at a depth of 2372 feet. Petrosud was organized by the Montecatini Chemical Products and Mining Company and American International Fuel and Petroleum Company on behalf of Gulf Oil Corporation.

About nine miles south of the Black Swan in Casalincontrada zone, Montecatini has begun rigging up Chieti 1 to test the extension of the Alanno structure. Gulf spokesmen have said any estimate of production is premature until these wells have been drilled to at least 6560 feet to 9850 feet.

Confirmation has been reported, too, that after three months of drilling at Tabuna, near Ragusa, a little more than a mile from the Pendente oil wells Gulf has found a new oil structure at 6889 feet which is producing 19-gravity crude.

Signor Annibale Bianco, assessor for industry of the Sicilian Regional Government, has said this discovery confirms his government's position in entrusting oil exploration in Southern Sicily to Gulf.

Austrian Drilling Equipment Being Shipped to Yugoslavia

Two Danube freighters left the Vienna, Austria, Soviet harbor at year's end with oil equipment for Yugoslavia's Klostar-Ivanic fields. The equipment, mostly drilling rigs, were from Austrian firms at present under Soviet management but are labeled "Made in the Soviet Union."

Significant Natural Gas Find Reported From Israeli Site

Israel-American Oil Corporation has reported discovery of the first natural gas deposit in Israel which may have commercial possibilities. The discovery was made near the industrial area of Petah Tiqva, three and a half miles northeast of Tel Aviv.

The gas occurrence was found in shallow sands at about 600 feet during a core drilling operation to test geological formations in connection with the company's oil exploration activities.

Reportedly, the gas deposit may cover between three square miles and eight square miles. Shallow depth of the gas sands coupled with the proximity of the deposit to the Tel Aviv industrial area makes further exploratory efforts attractive.

After the core hole was capped, another was drilled, about 100 feet south of the first, to a depth of 508 feet at which point electric log showed three possible gas horizons: 473-477 feet, 377-388 feet and 321-331 feet.

The casing was gun perforated with 16 shots between 473 and 477 feet. After the fluid was bailed down to 150 feet, the well cleaned itself, blowing mud 30 feet in the air. It was allowed to blow unchecked for 1½ hours before shutting down.

According to estimates, the well was blowing about 100 Mcf. daily.

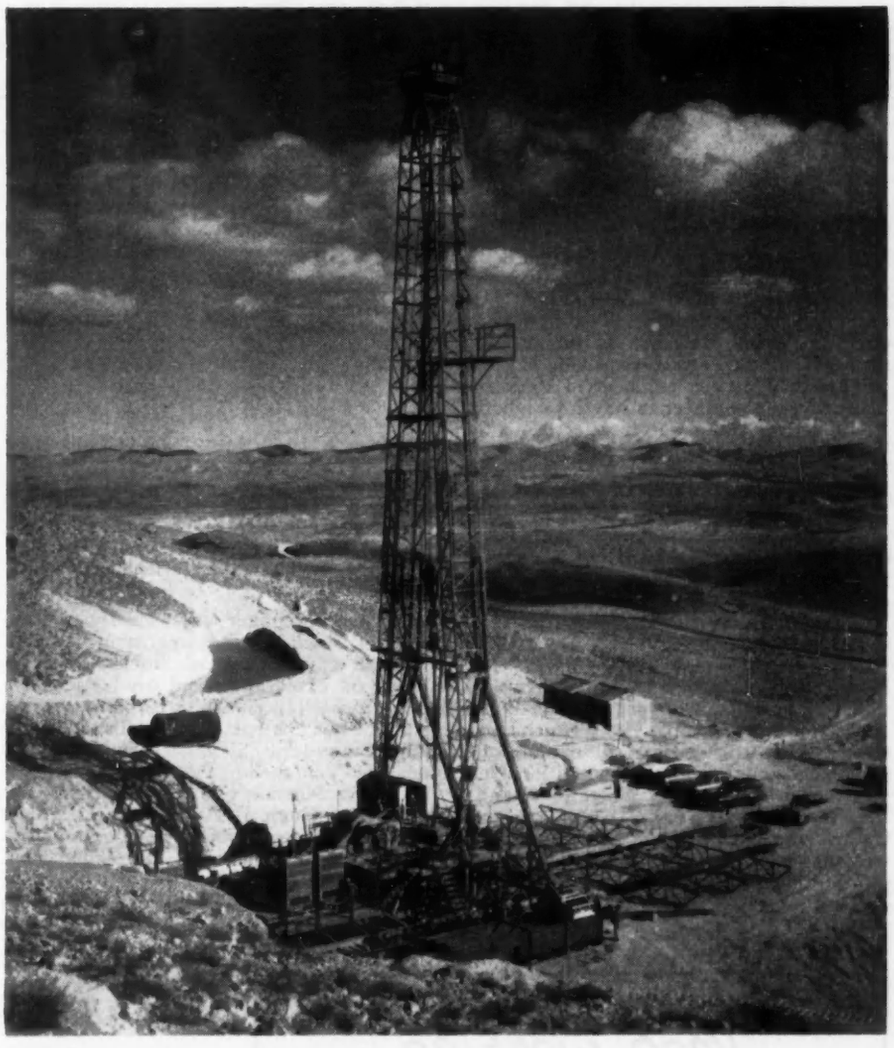
One of eight independent oil companies currently conducting exploration activities in Israel, Israel-American now has one deep test, Rekmeh 1, under way on its Boqer License, 25 miles south of Beersheba. This well is drilling ahead at 4300 feet, and is scheduled to be drilled to 7500-8500 feet.

Site for a second well near the Dead Sea on the Engedi License has been selected, and spudding in was scheduled for late in February.

Mexico Drills Fewer Wells But Ups Average Yield

Fewer wells drilled but higher average yield marked the first eight months of 1954, according to the Mexican government's department of statistics.

Two hundred new wells were completed of a total of 206 on which drilling was begun. Of those completed, 135 yielded commercial results, adding 80,000 barrels of crude and 38 Mcf. of gas to Mexico's daily production.



THE DERRICK at Israel-American Oil Corporation's Rekhme 1 casts a long shadow on the Biblical land of Abraham. The water reservoir, left background, delivers approximately 300 barrels of water hourly to drilling site. This deep test, scheduled to a maximum depth of 8500 feet is 25 miles south of Beersheba. In this picture below, crew members make last minute preparations on Rekhme 1 test before the bit and drill collars swing into the rotary table to begin drilling operations.

What's Happening

AMONG MEN IN THE INDUSTRY

Kewanee Oil Company has announced the promotion of **Don E. Hockaday, Jr.** from secondary recovery engineer to chief engineer in the Tulsa office. The new chief engineer joined Kewanee as junior engineer at Odessa, Texas, in 1948. He was promoted to district engineer in 1949 and made division engineer in North Oklahoma in 1952. Hockaday was transferred to the Tulsa office as production engineer in 1953.

•

Philip C. Dixon has been named president of **Middle States Petroleum Corporation** to succeed the late **Joseph Glass.** Dixon, a petroleum engineer, had been vice president of the corporation since 1949. The board of directors also elected Dixon president and director.

•

Henry H. Neel has been appointed divisional exploration manager of **Tide Water Associated Oil Company's** Western division. Neel will supervise all exploratory, geological and geophysical activities. Neel started work with Tide Water in 1942 in the Geological department in Ventura, Calif. From 1943 to 1953 he received promotions to assistant paleontologist, geologist and district geologist of the Coastal District.

Edward L. Steiniger

Hugh M. Russell

Edward L. Steiniger was elected vice president of **Sinclair Oil Corporation** recently. He will have charge of Sinclair's foreign crude oil exploration and production program, which now includes operations in Venezuela, Ethiopia and Italian Somaliland. Since 1950, Steiniger had been president of Venezuelan Petroleum Company, in which Sinclair Oil holds interest. The election of **Hugh M. Russell** as president to succeed Steiniger also has been announced. A director of Venezuelan Petroleum Company since 1942, Russell was vice president from 1942 until 1952. Prior to his recent election to the presidency, Russell was assistant to the chairman of Sinclair Oil & Gas, the domestic crude oil producing subsidiary of Sinclair Oil. **F. A. Bush,** chief geologist for Sinclair Oil and Gas Company, while retaining his present duties, is transferring his headquarters from Tulsa to New York to succeed Russell as assistant to the chairman of that company.

•

Edward B. Wasson has joined **Cosden Petroleum Corporation** in Denver as Rocky Mountain division geologist. Wasson was employed by the California Company for six years as a geologist and geophysicist. After engaging in surface geological work in Nevada, Idaho and Utah, Wasson gained geophysical experience in southern Arkansas and the Rocky Mountains. He was recently division geophysicist for the California Company in Denver.

•

Richard A. Morse has been appointed associate director of **Gulf Research & Development Company.** He will have administrative direction of research concerned with drilling, production and transportation. For the past six years **Morse** has been connected with the Research department of Stanolind Oil and Gas Company.

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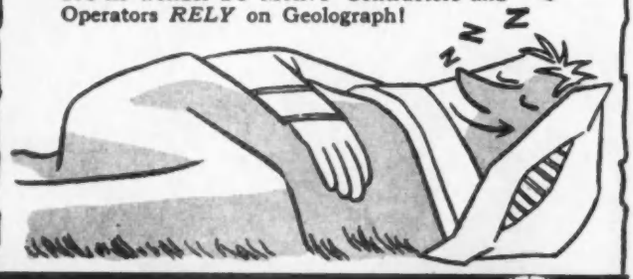

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M. G. Rowe

Hamilton Rogers

Rowan Drilling Company has announced the election of **M. G. Rowe** as president and **Rowan Oil Company** has elected **Hamilton P. Rogers** president. Rowe succeeds **C. L. Rowan,** who became chairman of the board. **A. H. Rowan,** former chairman of the board, remained as a director of the company. Rowe has been with the company since 1944 having served as chief mechanical engineer, assistant vice president, and vice president—drilling operations prior to his election to the presidency. Rogers became associated with Rowan in 1941 as landman. He later became head of the Land department, assistant secretary, and vice president.

•

W. B. Uderski, former director of the Petroleum Division of the United Nations Relief and Rehabilitation Administration, has opened offices in New York and Washington as an independent petroleum consultant. Uderski's firm will act as agent for independent oil companies, both American and foreign, in securing capital from private sources for exploration and development for these independent oil companies. Since 1951, Uderski has been in charge of the East Coast division of the D. D. Feldman Oil and Gas Interests of Dallas.

W. B. Uderski

•

R. E. McAdams, formerly manager of exploration for **Shell Oil Company's** Denver area, has been appointed manager of the firm's Exploration department, and transferred to the firm's head office. McAdams has been in the Exploration department about twenty years, having joined Shell as a geologist in the Texas-Gulf area in 1936. He rose to assistant district geologist, senior geologist, manager of Tulsa area exploration operations, and exploration manager in Denver.

•

Henry Carter Rea, petroleum consultant, has moved his offices from Casper, Wyo., to Denver.

•

I. S. Higginbotham has resigned from the geological staff of **Deep Rock Oil Corporation** and has opened an office as consulting geologist in Tulsa.

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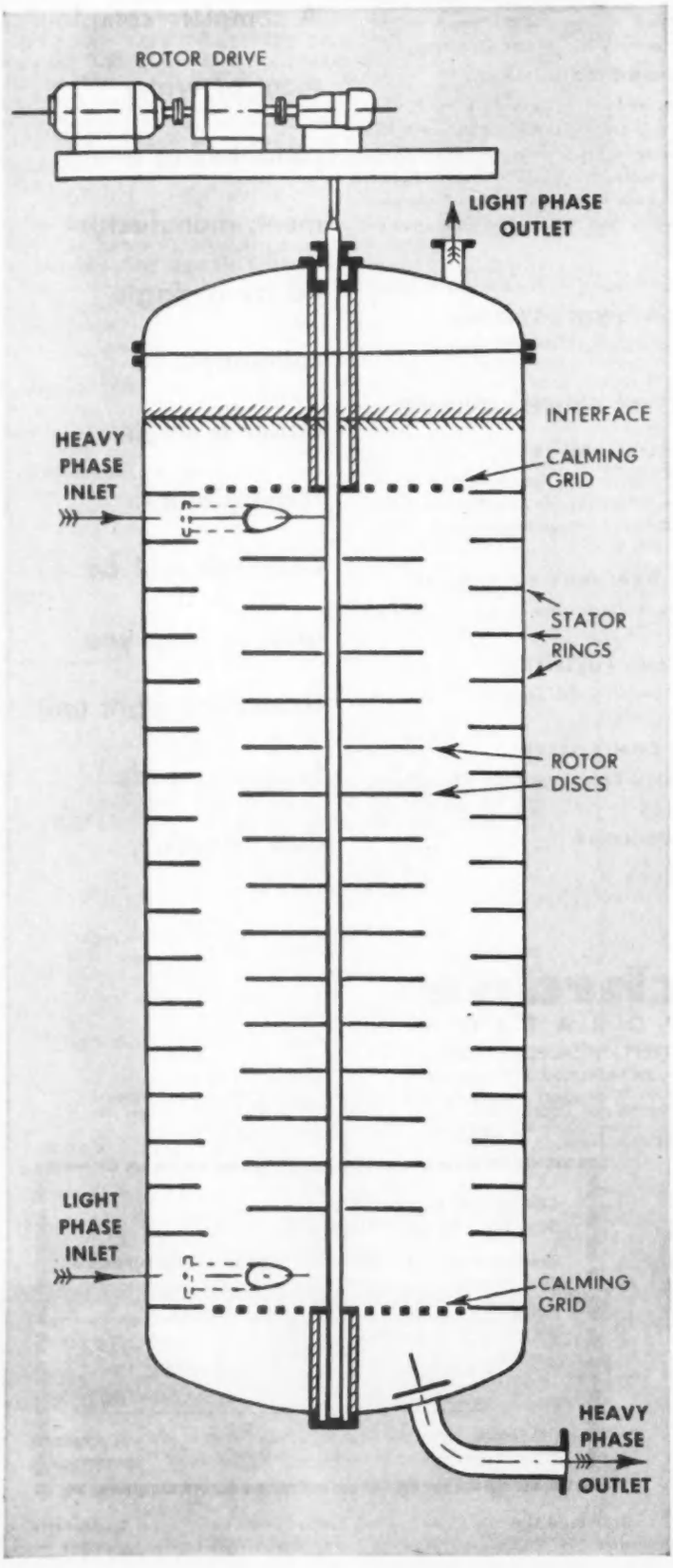

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George Bush

Wayne H. Dean

Hoyt S. Taylor

Hugh Liedtke

Zapata Petroleum Corporation has announced the formation of **Zapata Off-Shore Company,** with offices in Midland and Houston, to function as an affiliate of Zapata Petroleum. The announcement was made by Hugh Liedtke, president of Zapata Petroleum. **George Bush,** Midland, vice president and director of Zapata Petroleum, has been named president and chief executive officer of the new company. Bush has been engaged in the oil business for six years. **Wayne H. Dean,** formerly of Oklahoma City, has been elected vice president of the off-shore organization and will be in charge of its operations on the Gulf Coast and of its Houston offices. **Hoyt S. Taylor** has been named chief engineer for Zapata Off-Shore Company. He also will headquarter at the company's Houston office.

Both Dean and Taylor resigned executive positions with Kerr-McGee Oil Industries, Inc. with headquarters in Oklahoma City, to join Zapata. Dean formerly was manager of drilling for Kerr-McGee and for five years was in charge of Kerr-McGee's offshore operations. Taylor was with Kerr-McGee six years and at the time he resigned was its Gulf Coast Division drilling engineer. He was coordinator in charge of the construction of that concern's rig, Kermac 44, a recently completed mobile drilling platform which is now in operation.

Zapata Off-Shore Company has been organized, Bush said, to carry on drilling operations in the Gulf of Mexico.

Zapata Off-Shore's Houston office is in the City National Bank Building.

•

Claud B. Barnett, vice president, sales, has been named vice president for **The Texas Company** at Houston and **S. C. Bartlett,** general sales manager, has been elected vice president to succeed Barrett. Barrett succeeds **George R. Bryant,** who resigned his position as vice president to become president of Jefferson Chemical Company. Barrett joined The Texas Company as a salesman in 1927. He held increasingly

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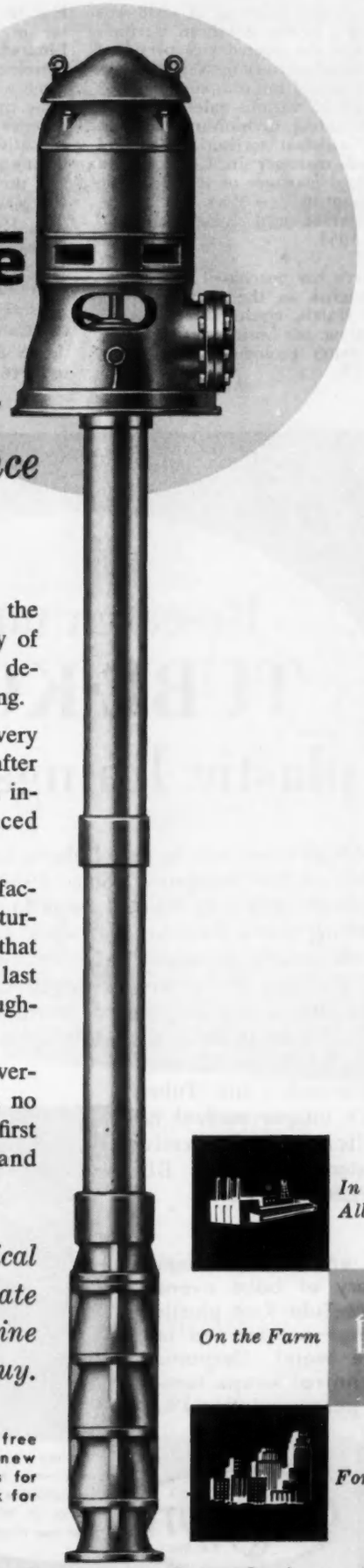

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important sales positions and in 1938 was named manager of the Southern territory in Houston. He was elected vice president —sales with headquarters in New York in 1953. Bartlett joined the company in 1924. He has served in various sales executive capacities, including division manager at Indianapolis, assistant territorial manager and territorial manager in Chicago and assistant general manager of the Domestic Sales department in New York. He became general manager of the Domestic Sales department in 1953.

•

Lloyd A. Harris has purchased the interest of **R. M. English** in the partnership of English and Harris, consulting geologists, and will continue the business as **Lloyd A. Harris**, petroleum geologists, with offices at Mattoon, Ill.

Harold C. Hose has been elected a director of **California Texas Oil Company, Limited.** Hose began his career in the petroleum industry in 1927 when he became a field engineer for The Texas Company at Port Arthur, Texas. He received a series of promotions to assistant to the executive vice president in 1950. The following year Hose joined Caltex as assistant vice president—North Europe and in 1953 was placed in charge of the European division. He was named vice president—marketing in 1954. The election of another director, **Murdo MacIver**, also was announced. MacIver has been vice president —fiscal matters since 1947. He came to the Caltex organization as general auditor in 1938 and was appointed comptroller in 1946.

Dudley G. Luce

Boris Gresov

Dudley G. Luce, president of J. G. White and Company, Inc., New York investment bankers, and **Boris Gresov**, economist with G. H. Walker & Co., New York and St. Louis investment bankers, have been elected directors of **Western Development Company.** J. G. White & Company, Inc., was the managing underwriter of a group of investment houses which earlier this year marketed 300,000 shares of capital stock of Western Development Company. Gresov formerly was vice president and production manager of Taxco National Mining Company, Mexico City. Since 1949 he has been in the investment banking business in New York. Western Development Company is engaged in the exploration, development and operation of oil, gas and other mineral properties, chiefly in New Mexico.

•

George A. Wilson, oil and gas executive, has been elected president of the **TXL Oil Corporation.** Wilson was president of Interstate Oil Pipe Line Company and the Yellowstone Pipe Line Company, affiliates of Standard Oil Company (New Jersey). Wilson resigned both posts to accept this new office. The board of directors also announced the election of **Maurice Newton**, partner, Hallgarten & Co., and **Maurice Meyer, Jr.**, partner, Hirsch & Company, as directors. Wilson succeeds **Col. George C. Fraser**, trustee and secretary of the Texas Pacific Land Trust, who had served as interim president since the formation of the new oil corporation in December, 1954.

George A. Wilson

•

Texas Gulf Sulphur Company has announced the retirement of **Albert G. Wolf** as vice president and manager of exploration of the company.

•

Charles E. Spahr, vice president and assistant to the president, has been elected executive vice president of **The Standard Oil Company (Ohio)**. The board of directors also voted to increase the number of directors from seven to ten. The following persons are to be nominated to fill these additional places: **Lawrence A. Appley**, president of the American Management Association, New York; **Thomas F. Patton**, assistant president and first vice president of Republic Steel Corporation, Cleveland; and Spahr.

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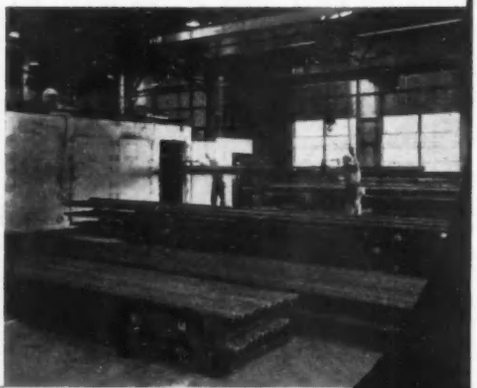

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David H. Rankin has joined **Fleeger-Riley Drilling Company** and **Star-State Drilling Company** as assistant to the president. In the oil business since 1948, Rankin has done seismograph, drilling and contractual work.

•

Thomas F. Taylor has been appointed vice president of **Grace Oil Company.** An independent consultant for the past three years, he was formerly district geologist for Pan American Production Company and later a member of the geological staff of Dow Chemical Company.

•

Stanolind Oil and Gas Company has announced the appointment of engineering supervisors in two district offices in the North Texas-New Mexico division. **E. M. Knight** has been named district engineer at Midland, Texas, and **F. H. Callaway** succeeds Knight as district engineer at Roswell, N. M. Knight joined Stanolind in 1946 as a roustabout in field producing operations at Brownfield, Texas. Since then he has held various engineering assignments in West Texas in the division office at Fort Worth and in Stanolind's general offices in Tulsa. Knight served as a petroleum engineer from 1949 to 1951 in the district office there. Prior to his latest appointment, Knight was for two years district engineer at Roswell. Callaway comes to Roswell from Tulsa, there he was petroleum engineering supervisor in Stanolind's general office. He joined Stanolind in 1946 as an apprentice engineer in the Tulsa office, where he rose through successive engineering classications. As petroleum engineering supervisor, Callaway had been directing reservoir engineering studies.

•

Max S. Houston has been named to head the exploration office of **El Dorado Refining Company** recently established in Denver. Houston has been associated with El Dorado as a geologist in its Wichita office for 3½ years. Formerly he was employed by Atlantic Refining Company, Kansas State Highway Commission and U. S. Geological Survey. Houston, a graduate of Kansas State College, will have offices in the Colorado Building.

Max S. Houston

•

Sunray Oil Corporation has announced the appointment of **M. C. Welch** to serve as assistant district superintendent for the corporation's field operations in California. This new post has been created to better coordinate and direct the activities of the producing, drilling, gas and gasoline and mechanical sections of the Production department. Prior to this appointment, Welch served as superintendent of the Gas and Gasoline division in California.

•

John W. Mecom, Houston oil operator, has announced the addition of **Paul J. Orchard** to the geological staff. Orchard had been a geologist with American Republic Corporation in Houston since 1950. Prior to that time, he was with the California Company in New Orleans and Continental Oil Company in Lafayette.

•

Alan J. Lowrey of San Francisco has retired as vice president of **Union Oil Company.** Lowrey will remain as a director of Union Oil with which he has been associated since 1939 when he became assistant to the president with headquarters in San Francisco.

•

James W. Graham, Jr., has been promoted from division engineer to gas engineer in the Tulsa office of **Kewanee Oil Company.** Graham joined Kewanee as district engineer at Pampa, Texas, in 1949. He was promoted to division engineer in the Panhandle (Texas) division in 1950 and transferred to Tulsa February, 1955.

•

Humble Oil & Refining Company has announced the promotion of **D. C. Rhodes,** district superintendent, Goose Creek district, Gulf Coast division, to assistant division superintendent, Gulf Coast division. **R. H. Ussery,** district superintendent, Bayou Sale district, Louisiana division, transferred to the Goose Creek district to replace Rhodes.

J. P. Malott

M. H. Dubrow

J. P. Malott, Houston, has been promoted to manager of **Continnetal Oil Company's** Production department. Formerly assistant manager of production for Continental, Malott will continue to make his headquarters at Houston. **M. H. Dubrow,** Houston, has been promoted to the newly-created position of chief engineer, Production department. Malott joined Conoco in 1935 as a roustabout at Jal, N. M. and held several positions in the company's Production department in New Mexico before his promotion in 1940 to division petroleum engineer in Houston. He was promoted to regional petroleum engineer in 1943, regional engineer in 1949 and assistant manager of the company's Production department in 1952. Dubrow joined Conoco in 1936 and held several positions in the Production department in New Mexico prior to his promotion in 1943 to division petroleum engineer at Fort Worth. He became regional petroleum engineer at Fort Worth the same year and was promoted to chief petroleum engineer for Conoco in 1947.

•

Harold L. Crisman, petroleum engineer for **Russell Cobb, Jr.,** indepedent oil operators of Tulsa, has resigned to become a consulting petroleum engineer. Crisman was for many years associated with W. C. McBride, Inc. in Oklahoma and Kansas.

•

John E. Blixt, former senior geologist for **The Texas Company's** Rocky Mountain area, has joined the firm of **Halbert and Jennings** in Denver and will be associated with the company in exploration and development of oil and uranium. For the past four years Blixt has been The Texas Company's senior geologist in Denver.

Deaths

Hiram H. Porter, 63, retired Tulsa oilman, died January 31. Porter was head of the Land department for the old Cosden Oil Company and its successor, the Mid-Continent Petroleum Corporation. Later he was an independent operator until his retirement four years ago.

•

Raymond Godet, president of Forex, the only oil drilling contractors in France during the 15 years since the founding of the company, died in Paris January 24. Godet went to Russia and Roumania as petroleum engineer for Petrofina, French and Belgian oil company, and upon his return to France, he built one of the largest French refineries at Berre, serving as general manager until 1940.

I. H. Terhune, 73, Oklahoma oilman, died in Bartlesville February 11. Terhune started in the oil business at the age of 16 and worked for several oil companies before becoming an independent operator.

•

Paul S. Nunley, 52, general traffic manager of Phillips Petroleum Company died January 31 in St. Louis. Formerly with the Independent Oil Company in Tulsa, he transferred to Bartlesville when the company was purchased by Phillips.

•

Joseph W. Miller, 43, representative of the Oil Industry Information Committee of the American Petroleum Institute in Chicago, died February 3. He joined the API public relations organization in 1951.

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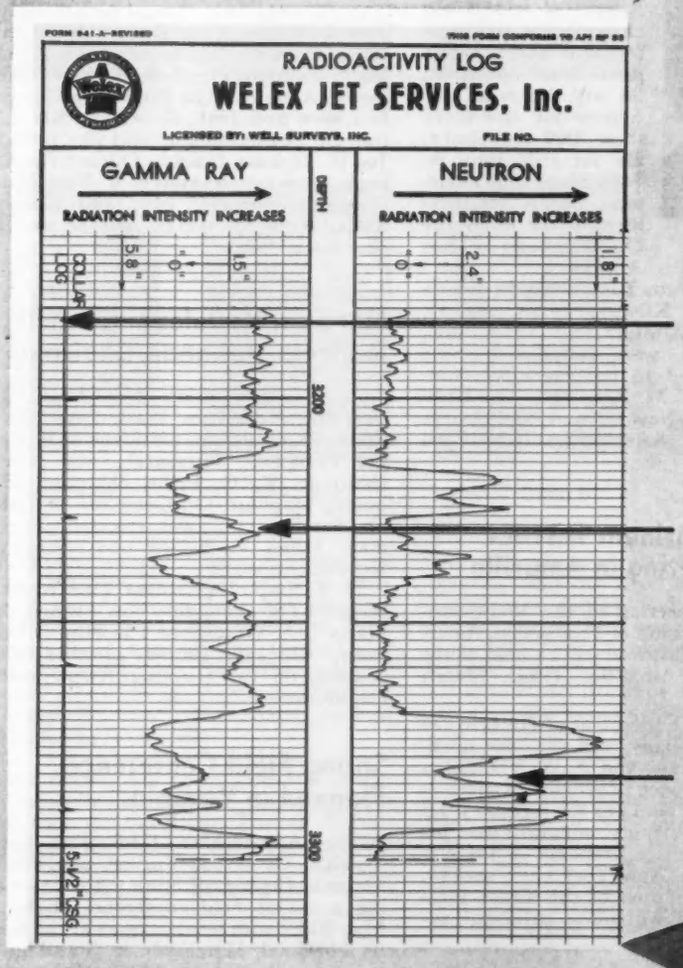


The Casing Collar Log accurately locates your casing collars and definitely ties them in depth to the tops and bottoms of the formations, as indicated by the Gamma Ray—Neutron Curves. The Casing Collar Log is run simultaneously with the Gamma Ray—Neutron Curves at no extra cost to the operator.

The Gamma Ray Log gives you clear, sharp, repeatable definitions of the formations traversed in the borehole. Accurate location of the formation with the Gamma Ray Curve eliminates guess work in perforating and well completion practices.

The Neutron Curve gives you clear definitions of the zones in which you are completing, indicates porosity, and is adaptable to quantitative analysis.

Combined, the Casing Collar Log, the Gamma Ray Curve, and the Neutron Curve give you accurate well information which is obtained in a single run, eliminating additional down-time.

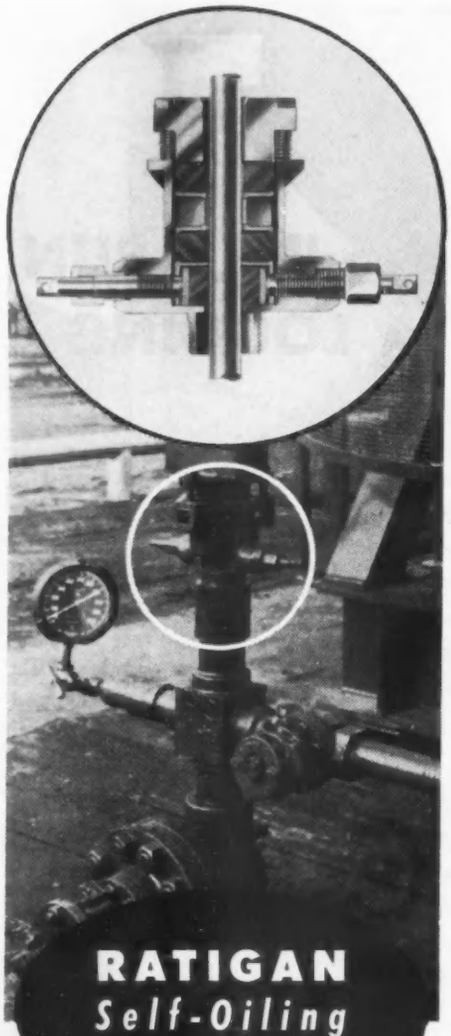
ORIGINATORS OF Welex JET PERFORATING

Welex JET SERVICES, INC.

Call Welex and be Sure!

General Offices: 1400 East Berry, Fort Worth, Texas • *Division Offices:* Houston • Midland • Tulsa • Oklahoma City

District Offices: Abilene – Ardmore – Bartlesville – Beaumont – Corpus Christi – Falfurrias – Gainesville – Great Bend – Hobbs – Houston Lafayette – Liberal – Odessa – Pampa – Pauls Valley – San Angelo Shawnee – Snyder – Stillwater – Wichita Falls – Winfield



. . . is the only unit of its kind on the market today, receiving lubrication directly from the pumping well. It is made of high grade electric steel with inner bronze parts and greatly increases the safety and efficiency of a pumping well.

The No. 176 has a shut-off feature which enables the operator to shut-off while repacking the box . . . simply tighten the screws evenly in the shut-off. Caution must be exercised however, as the screws will have to be loosened before the well starts to pump, otherwise fluid will not get up into the oil chambers.

SOLD BY LEADING SUPPLY STORES EVERYWHERE

J. P. RATIGAN, Inc.
1213 Santa Fe Ave., Los Angeles 21
Export: National Supply Co., Inc., Export Div.
600 Fifth Ave., New York 20, N.Y.

What's Happening

AMONG INDUSTRY ASSOCIATIONS

AIME Petroleum Branch Installs New Chairman

R. B. Gilmore, vice president in charge of Mid-Continent operations for DeGolyer & MacNaughton, Dallas consultants, has been installed as chairman of the Petroleum Branch of AIME. As chairman of this professional society for petroleum engineers, he will direct all activities for the more than 7000 members. He succeeds John R. McMillan, 1954 chairman, who is vice president of the Monterey Oil Company of Los Angeles.

R. B. Gilmore

Phil J. Lehnhard, East Texas Engineering Association, Kilgore, Texas, and C. Latham Yates, Amstutz and Yates, Inc., Wichita, Kansas, were installed as vice chairmen. Elected to the executive committee were Earl M. Kipp, Jr., The California Company, New Orleans, and George R. Gray, Baroid Sales Division, National Lead Company.

API Mid-Continent District To Hold Meeting in Amarillo

The annual meeting of the Mid-Continent district, Division of Production, American Petroleum Institute will be held at the Herring Hotel, Amarillo, Texas, March 23-25.

Rex Baker, vice president of Humble Oil & Refining Company, will give the opening keynote address, and A. W. Thompson of Houston, API vice president for production, will present citations for service. J. Ed Warren, former deputy administrator for defense and now vice president of the National City Bank, New York City, and Lt. Gen. E. O. Thompson of the Texas Railroad Commission will make principal addresses.

Production Division of API Plans New Orleans Meeting

More than 1000 oil men are expected to attend the spring meeting of the Southwestern District of the Production division of the American Petroleum Institute at the Jung Hotel in New Orleans March 9-11. The district encompasses part or all of Louisiana, Texas, New Mexico, Mississippi and Arkansas.

The meeting will open with a number of sessions of working committees. Reports will be made on studies of crude oil and natural gas drilling and production problems and techniques.

At the general session "Citations of Service" will be presented to individuals in the district who have made outstanding contributions to the petroleum producing industry. The awards will be presented by A. W. Thompson, of A. W. Thompson, Inc., Houston, API vice president for production.

Rocky Mountain Geologists Elect Maxson President

New officers of the Rocky Mountain Association of Geologists are John H. Maxson, consultant, president; Jack W. Knight, British-American Oil Producing Company, first vice president; Robert L. Kretz, Petroleum Consultants, second vice president; Joe W. Jackson, Sinclair Oil and Gas Company, secretary-treasurer. B. Pete Harder, Geophoto Services, Inc., and Robert J. Knox, Knox, Bergman and Shearer, are new councilors.

National Petroleum Council Reelects Hallanan Chairman

At a recent meeting of the National Petroleum Council in Washington, D. C., Walter S. Hallanan, president of Plymouth Oil Company, Pittsburgh, was reelected chairman. R. G. Follis, chairman of the board, Standard Oil Company of California, San Francisco, was reelected vice chairman. James V. Brown was re-appointed secretary-treasurer.

D. T. Staples, president Tide Water Associated Oil Company, San Francisco, replaces L. S. Wescoat of The Pure Oil Company, Chicago, former member of the council, on the standing Appointment Committee.

Spring Field Conference Planned in Virginia

The Appalachian Geological Society, Virginia Geological Survey, and the West Virginia Geological Survey are co-sponsoring a major field conference to be held May 20-22 with headquarters at the Kavannaugh Hotel, Harrisonburg, Va. This conference will study the older Paleozoics of the Appalachians, ranging in age from the basement complex upward through the Cambrian, Ordivician and Silurian Systems.

TIPRO to Have Gas Forum At Annual Convention

A natural gas forum in which Texas Independent Producers and Royalty Owners will discuss bills in the Texas Legislature and Congress dealing with the gas price problem will be held at the opening session of the association's ninth annual meeting March 27-29 in Fort Worth.

Walter S. Hallanan, president of Plymouth Oil Company and chairman of the National Petroleum Council since its organization by presidential directive in 1946, has been selected to receive the annual "recognition award" presented by TIPRO.

What's Happening

AMONG SERVICE AND SUPPLY MEN

E. E. Rubac

W. R. Wheeler, Jr.

Eugene Caillet

Clifford LeBlanc

W. F. Maggert

C. N. Hughes

Tom Seago

L. A. Estes

W. C. Hale, Jr.

R. F. Bradshaw

D. W. Whittenberg

William H. Zepp

E. E. Rubac, executive vice president and **W. R. Wheeler, Jr.,** assistant sales manager of the **American Iron and Machine Works Company** of Oklahoma City, have returned from tours of the Central and South American countries. Wheeler's trip included contacts in Argentina, Bolivia, Peru and Equador while Rubac covered operations in Venezuela.

Eugene Caillet has been appointed assistant manager of molded and extruded goods sales at **Goodyear Tire & Rubber Company's** St. Mary's, Ohio, plant. Caillet joined Goodyear in 1948 as a sales engineer. He was later assigned to molded goods sales, serving until his recent appointment.

Clifford H. LeBlanc has been named president of **Gulf Coast Machine & Supply Company** in Beaumont, Texas. A graduate engineer, LeBlanc joined the company in 1933 and, during the past four years, has served as executive vice president and general manager.

W. F. Maggert has been appointed welded tank product manager for **Butler Manufacturing Company.** Maggert assumes the responsibility of design and programing the sale of welded tanks. He has been associated with Butler Manufacturing Company since 1946 and prior to his new position was assistant welded tank product manager.

Great Bend Fishing Tool Company of Great Bend, Kansas, an affiliate of Acme Oil Tool Company, Oklahoma City, has announced the appointment of **Tom Seago** as manager of the Liberal, Kansas, fishing tool shop. Seago replaces **C. N. (Shorty) Hughes,** who has been assigned to Great Bend's new fishing tool shop at Borger, Texas. Seago has been associated with Acme Oil Tool Company and Great Bend Fishing Tool Company since 1943, when he joined the company as a fishing tool operator. He was promoted to fishing tool superintendent in September, 1952 and to manager of Acme's Wichita Falls, Texas, fishing tool shop in 1953. Hughes has been associated with Acme Oil Tool Company since 1944, and originally joined the company as a fishing tool operator. He has had more than 25 years experience in rotary and cable drilling, having worked as a roustabout, pumper, roughneck, driller, tool pusher and fishing tool operator.

Dodge Steel Company has announced the election of **L. A. Estes,** president; **W. C. Hale, Jr.,** executive vice president; **R. F. Bradshaw,** financial vice president and secretary; **A. S. Breithaupt,** vice president—sales; **M. D. Leopold,** treasurer; and **N. G. Kriebel,** assistant treasurer. Dodge Steel Company is a wholly-owned subsidiary of South Chester Tube Company of which Estes is president; Hale, executive vice president; Bradshaw, secretary and treasurer; and Kriebel, assistant treasurer.

D. W. Whittenberg has been named general sales manager of **Garrett Oil Tools, Inc.** of Longview, Texas. He is a vice president of the company and formerly was manager of its southern sales region. As general sales manager, Whittenberg will be in charge of the entire sales and service program. He will continue to make his headquarters in the Houston offices.

Templeton, Kenly & Co. has named **William H. Zepp** as Western district sales manager. He will cover the states of California, Arizona, Nevada, Oregon and Washington with headquarters in the San Francisco Bay area. Zepp formerly was Midwestern district sales manager for Templeton, Kenly.

T. G. McLaughlin has been named chief engineer of **Avondale Marine Ways, Inc.** of New Orleans, to head up a large expansion program in the company's engineering organization and facilities. McLaughlin, former manager of the Avoncraft division, replaces **Sam P. Stone** who has been named technical assistant to **Henry Z. Carter,** executive vice president.

Houston Oil Field Material Company, Inc. has promoted **Donald Erskine** from field salesman at Sullivan City, Texas, to manager of the Homco store there. **W. S. George,** formerly field salesman at Alice, Texas, is now handling telephone sales in the Houston office. **Richard Morgan** has been transferred from Freer, Texas, to Odessa, and **J. W. Clampitte** has been transferred to the directional drilling department in Houston as sales and service engineer. He was formerly directional drilling superintendent in Corpus Christi. In Odessa, **F. E. Sandefer** has been promoted from directional drilling engineer to field representative. **Frank Singletary,** formerly directional drilling superintendent of the West Texas area, has been named to succeed Clampitte in Corpus Christi. In New Iberia, La., **W. J. Upton** has been promoted from office clerk to assistant store manager.

Natural gas producers, small and large, are convinced that if the American people understand the issues regarding federal regulation they will reach the right decision. Therefore, we are endeavoring to lay the subject before the people and to encourage the fullest possible discussion of the issues. To do so, this advertisement has been placed in newspapers throughout the country.

What the Regulation of Gas Supply Means to 25,000,000 American Families

THE FIVE THOUSAND producers of natural gas—large and small—believe that the free competitive system which has increased your gas supplies and kept rates low is the best for consumers, for the industry, and the economy.

They believe the proposal to abandon competition and clamp bureaucratic controls on gas production will hurt consumers, damage the industry, and *benefit no one*.

Here are some answers to questions you as a consumer may have on this vital issue.

What Is This Regulation?

Sixteen years after a 1938 law was passed, a new interpretation of some of its words now forces the Federal Power Commission to do what it has eleven times refused to do—try to fix the price that an interstate pipeline pays the 5000 competing producers who find the gas and get it from the ground.

Will This Regulation Reduce Our Gas Bills?

Hardly. Only about 10% of the average gas bill goes to the producer who finds the gas and sells it. The other 90% pays for constructing, maintaining and operating the long-distance pipelines and local distribution systems—already regulated.

How Will Regulation Affect Supply?

It will reduce the supply. Most natural gas is produced by "wildcatters" and other independents. They are used to keen competition and big risks. But put them under Federal controls—with permits, endless forms, licenses, hearings and suits—and the work of exploration is sure to suffer. Three new pipeline projects to bring gas to more consumers have been suspended since regulation took effect.

Hasn't Gas Always Been Regulated?

Gas *distribution*, yes. It makes sense to have only one pipeline bring gas to a community—and one gas company distribute it in the community. Both do a good, efficient job for you, and as monopolies they are naturally regulated.

But there's no monopoly in *finding* gas. Far from it. Gas *production* is risky and keenly competitive. There are five thousand large and small producers looking for gas—and finding it in only one out of

every nine exploratory wells they drill. They compete vigorously to sell their gas. A single pipeline may buy from 200 or more producers.

Is Gas Different from Coal or Oil —or Grain?

It isn't. And if there's price-fixing for natural gas at the well so can there be next for coal at the mine or oil at the well—or lumber in the forest, or grain on the farm.

How Did The Consumer Fare Before This Regulation?

Here's the record. In the past 16 years natural gas production has increased 200% and the price the consumer paid for gas has risen only 1/11th as much as the general cost of living.

Do Only A Few Big Companies Produce Gas?

No. The largest 37 companies produce less than half the nation's gas. No single company produces more than 5%. The small producers do more exploratory drilling than do all the big companies combined. And none of the producers has any monopoly, any exclusive franchise, or any protection.

What Is The Natural Gas and Oil Resources Committee?

It is made up of companies and individuals concerned with natural gas. It includes a great many large and small gas and oil producers. All believe there is no more reason for OPA-like price-fixing on gas than on steel, coal, autos, meat, or shoes, which could be next. All believe that free competition is better for all of us than a price-controlled economy, which has historically led to stagnation, scarcity and rationing.

What Can I Do?

You can reason out the issues, reach your own conclusions, and make those conclusions known to your friends and neighbors.

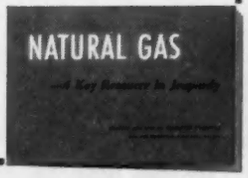
Under free competition without federal regulation—

- **Natural gas became plentiful—output rose two hundred per cent in the past sixteen years.**
- **Natural gas stayed reasonable—and gas prices to the consumer rose only one-eleventh as much as living costs in the past sixteen years.**
- **Natural gas has helped create thousands of jobs in industry and now supplies one-fourth of the nation's energy resources.**

***NOW*.....cumbersome federal controls threaten all this progress.**

FOR MORE FACTS WRITE FOR THIS BOOKLET NOW!

You have the right to know the facts about this new government regulation—a peacetime control of free, competitive producers. Send today for the booklet, "Natural Gas—A Key Resource in Jeopardy."

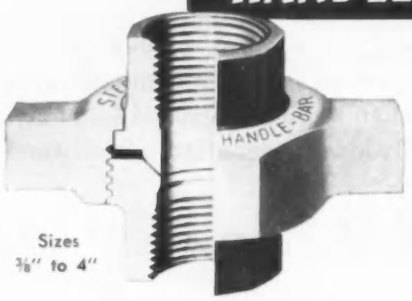


NATURAL GAS AND OIL RESOURCES COMMITTEE

Room 5401, 350 Fifth Avenue, New York 1, N. Y.

PRESSURES AND TEMPERATURES are SAFE in these

"HANDLE-BAR" 4000 TEST



Sizes 3/8" to 4"

FORGED STEEL UNIONS

A skillfully engineered seat design provides the perfect seal for holding securely rated temperatures and pressures. Advanced manufacturing methods, rigidly controlled step by step to maintain the highest standard of quality, produce these accurately finished, rugged Handle-Bar Unions.

Quick and Easy to Make and Break because the nut threads are permanently lubricated with Udylite Cadmium. The Extra Heavy Nut provides the strength necessary to withstand rough handling and excessive abuse. So Great in Value . . . So Low in Cost.

WRITE TODAY FOR OUR FREE, NEW, COMPREHENSIVE CATALOG

Clayton Mark & Company

1900 DEMPSTER STREET · EVANSTON, ILLINOIS · U.S.A.

OVER 100 GPH FOR EACH POUND OF PUMP

YET THIS *FLOMAX-15* IS MADE OF TOUGH IRON FOR LONG LIFE

EASY TO HANDLE——WEIGHS LESS——COSTS LESS

FLOMAX Super Hard Seals provide longer trouble-free pump life without nuisance of filling grease cups or fear of dirty grease.

FLOMAX Open Adaptor construction protects your engine from stray pumpage. Also provides plenty of room to work and see when servicing pump.

FLOMAX pumps are	*FLOMAX* pumps have
Self-Cleaning	Replaceable Wear Plate
Non-Clogging	Removable Inlet and Outlet Flanges
Quick Priming	Higher Capacities and Higher Heads

MP

Write for free folder!

MARINE PRODUCTS COMPANY

515 Lycaste Ave., Detroit 14, Michigan

Glen W. Peters

D. H. Vandenberg

R. G. Seim

M. W. Cook

Fluid Packed Pump Company has announced the promotion of **Glen W. Peters** to assistant vice president and acting manager of the Southwest division, and of **D. H. Vandenberg** to manager of product sales. Peters has served the company in various capacities since 1941 and will direct the sales activities of the Southwest division. Vandenberg, formerly manager of the Southwest division, started with the company in 1940 in the Manufacturing department, transferring to the Sales department in 1953.

R. G. Seim has been appointed assistant district manager of **Continental Supply Company's** Illinois-Indiana-Kentucky district. He will work under the supervision of **C. H. Fischer**, district manager, with headquarters in Evansville, Ind. Seim joined Continental at Duncan, Okla. in 1948. Since 1950 he has been in Casper, Wyo. in charge of credit work in the Rocky Mountain district.

M. W. (Monk) Cook has been appointed a field engineer for **Chiksan Company.** He will cover the petroleum drilling, production and marketing industry throughout southern California. Cook comes to Chiksan with a background of more than 35 years in the oil industry. He started as a roughneck in 1919 at Taft, Calif. He has represented Chiksan and other equipment companies in the Near and Middle East.

Continental Supply Company has announced the following personnel changes: **Frank Hord**, Corpus Christi field salesman, named city salesman in Houston; **B. G. Patterson** named field salesman at the Corpus Christi store; **C. B. Herring**, Corpus field salesman, promoted to store manager at Victoria, Texas; **Freddie Vincent**, Houma, La., store manager, moved to New Orleans as sales representative; and **Frank E. Ellis** moved from New Iberia, La., to Houma to replace Vincent. **Morris S. Holleman** has been named to succeed Ellis at New Iberia; **R. R. Schramm**, former bookkeeper at Williston, N. D., has been made field salesman at Artesia, Colo.; and **William H. Long, Jr.** has been named city salesman at Oklahoma City and **John D. Craddock**, salesman at Tyler, Texas.

Norman W. Rowand

Paul A. Mankin

Arthur W. Krause

Roland W. Bartlett

Rockwell Manufacturing Company has promoted three Pittsburgh officials to new management posts. **Norman W. Rowand,** general manager of the Pittsburgh division, has been named assistant to the vice president; and **Paul A. Mankin,** chief engineer of the local division, has been named general manager. **Arthur W. Krause,** assistant general manager, has been named factory manager.

Roland W. Bartlett has been promoted to manager of **Worthington Corporation's** Detroit district office. Bartlett goes to Detroit from a succession of advancements, his most recent post being that of sales engineer in the company's Washington, D. C. district office where he handled government accounts, utilities and export business. Bartlett joined Worthington in 1940, left for military service, and returned five years later. He became sales engineer in the Wilmington branch office and in 1948 was made manager of that office. In 1950 he transferred to Washington.

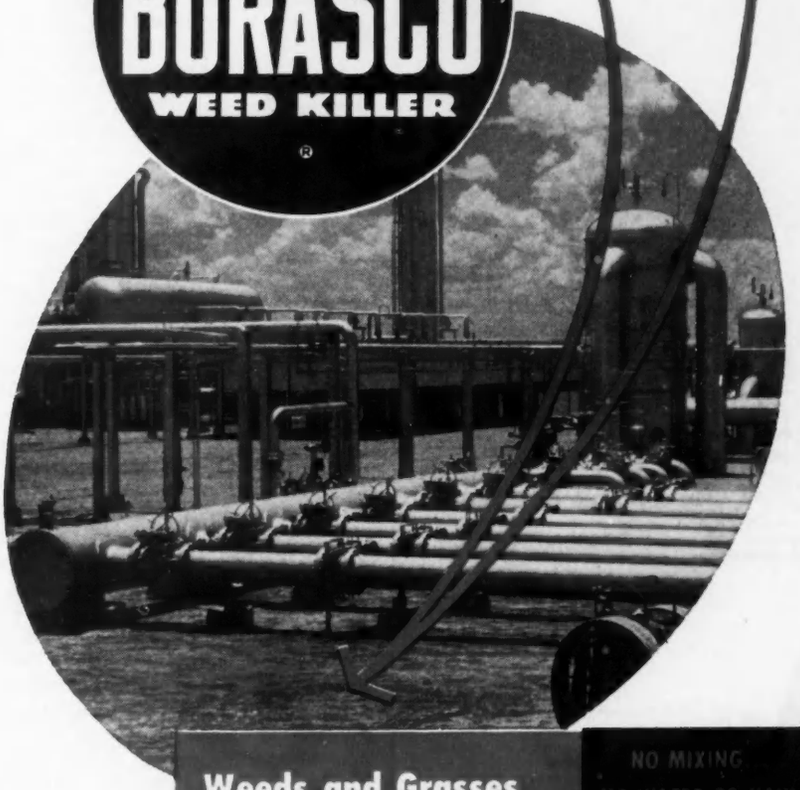
Armand Vaussine, field representative for **United States Steel's Oil Well Supply Division,** has been transferred from Lake Charles, La., to New Iberia. He has served as field representative at Lake Charles since joining Oilwell in 1953.

James Bayliss, Brisbane, Australia, has been appointed representative for the **S. R. Bowen Company** in Australia, British New Guinea and New Zealand. Bayliss has had many years of field experience in all phases of drilling operations in that part of the world.

Don S. Permar has been named field sales manager of **Le Roi Division of Westinghouse Air Brake Company. Permar moves** from his position as sales manager of stationary air compressors. In 1945 he joined Westinghouse Air Brake as a pneumatic engineer and became a special representative for the Industrial Products division the following year.

Wherever weeds and grasses are a fire hazard... use...

CONCENTRATED BORASCU WEED KILLER ®



Weeds and Grasses Can't Grow on Ground Treated with Borascu

NO MIXING
NO WATER TO HAUL
NONPOISONOUS
NONCORROSIVE

the easy way

a single application of Borascu Weed Killer may keep an area cleared for 1 or 2 years!

You won't know how easy it is to cut your "grassing" maintenance costs until you try Borascu! Then you may find, as others have, that your costs will tumble as much as 80%! That's because one speedy application of low-cost Borascu destroys vegetation and prevents its return for many months afterwards... with safety. Write today for literature and where to buy.

DISTRIBUTORS LOCATED THROUGHOUT OIL FIELDS OF U.S.A., CANADA, MEXICO, COLOMBIA, VENEZUELA.

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

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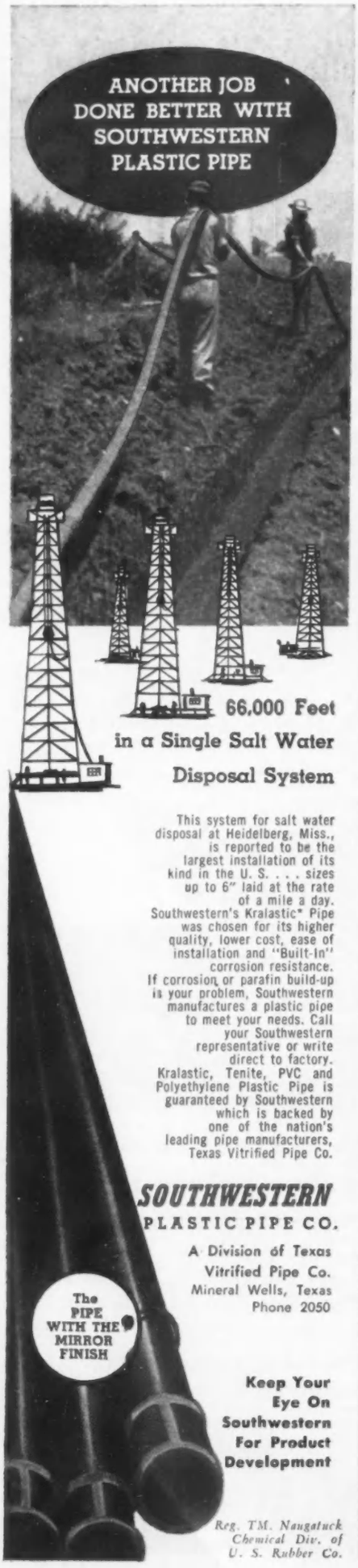
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DONE BETTER WITH
SOUTHWESTERN
PLASTIC PIPE
66,000 Feet
in a Single Salt Water
Disposal System
This system for salt water disposal at Heidelberg, Miss., is reported to be the largest installation of its kind in the U. S. . . . sizes up to 6" laid at the rate of a mile a day. Southwestern's Kralastic* Pipe was chosen for its higher quality, lower cost, ease of installation and "Built-In" corrosion resistance.
If corrosion or parafin build-up is your problem, Southwestern manufactures a plastic pipe to meet your needs. Call your Southwestern representative or write direct to factory.
Kralastic, Tenite, PVC and Polyethylene Plastic Pipe is guaranteed by Southwestern which is backed by one of the nation's leading pipe manufacturers, Texas Vitrified Pipe Co.
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WITH THE
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FINISH
Keep Your
Eye On
Southwestern
For Product
Development
Reg. TM. Naugatuck
Chemical Div. of
U. S. Rubber Co.

Gulfco Sales Staff Meets

Attending the first 1955 sales meeting of Gulf Coast Machine & Supply Company were: (front row, left to right) E. L. Mick, Seminole, Okla.; E. J. Noble, Casper, Wyo.; Clifford H. LeBlanc, president and general manager, Beaumont; M. E. McKelvey, Wichita Falls; J. C. Newman, sales manager, Beaumont; (back row) E. S. Stuart, chief accountant, Beaumont; Paul C. Smith, Odessa; D. R. Etzel, Houston; Thomas A. Balmer, chief engineer, Beaumont; E. V. Metcalf, Jr., Beaumont; Leonard F. Cowan, district sales manager, Dallas; W. H. Womble, Oklahoma City; Lester D. Farley, Corpus Christi; and Bob Williamson, Casper.

Lee S. Cline has been named assistant vice president-production of U. S. Steel's Consolidated Western Steel division. He will be responsible for all production operations at Consolidated's Orange, Texas, plant and for all field construction operations throughout the division. Cline joined Consolidated Western Steel in 1939. **Norman M. Sted,** who started his career with the American Steel & Wire Division as an office boy in Cleveland, has recently been made assistant general manager of sales. He will assist **John Graham,** general manager of sales, in handling all general sales activities of the division. In U. S. Steel's Oil Well Supply division, **Wallace L. Reed** has been transferred from New Orleans to Houston as district engineer; **Winifred Berl Potts,** storeman in Big Spring, Texas has been promoted to field representative at that city; **Richard E. Yates,** field representative at Odessa, has been named manager of the Sundown, Texas, store; and **Joe Lloyd Ward,** storeman at Odessa, has been promoted to field representative. In the same division, **George A. Hanson,** credit manager of "Oilwell's" Central Midwest area, has retired. He joined the company at Fort Worth in 1922 as collection clerk.

G. W. (Bill) Davidson has been promoted to vice president—sales of **W. C. Norris Company. Art Miller** is advanced from assistant sales manager to sales manager and **Paul Hagaman,** Tulsa sales, becomes assistant sales manager. Davidson has been with the Norris Company 19 years, coming to Tulsa as city salesman from the Wichita Falls territory in 1944, advancing to sales manager in 1946. Miller handled Tulsa city sales prior to becoming assistant sales manager. Hagaman served as branch manager at Salem and St. Elmo 14 years before moving to Tulsa in 1954.

Joseph T. Ryerson & Son, Inc., has announced the appointment of **John W. Bodwell** as manager of the work order division. He succeeds **William G. Findlay** who was named assistant manager of the Ryerson plant in Detroit. **Harold W. Davidson,** sales representative for the department, succeeds Bodwell as manager of the word order department, Chicago plant.

Bethlehem Supply Comany has announced the following personnel changes in the North Texas district: **J. P. Chance,** Wichita Falls city salesman, has been promoted to store manager succeeding **H. E. Williams** who becomes chief clerk to **W. E. Stephenson,** district manager at Wichita Falls; **L. T. Little,** machinery serviceman at Wichita Falls, promoted to field salesman at Abilene; **D. A. Hutson,** pump shop operator at Abilene, promoted to field salesman; **B. J. O'Dell,** chief clerk, promoted to assistant store manager at Whitesboro; and **R. E. Ligon,** chief clerk at San Angelo, promoted to field salesman at Whitesboro.

Paul D. Sullivan has been named assistant sales manager of **Le Roi Division,** Westinghouse Air Brake Company. Sullivan, who will have headquarters in Milwaukee, moves from New York where he has been in charge of contractor sales since joining the Le Roi Division a year ago. He will be concerned with promoting the sale of Le Roi portable air compressors and Westinghouse stationary air compressors.

Dr. Franklin E. Lowance has been appointed director of research and engineering for **Westinghouse Air Brake Company** to direct the company's program and coordinate the research and engineering activities of all subsidiaries and divisions of Westinghouse Air Brake.

Raybestos-Manhattan, Inc. has elected **S. R. Zimmerman, Jr.** and **H. H. Burrows** vice presidents and **R. J. Gorecki,** director. Zimmerman is presently director and assistant general manager of the U. S. Asbestos—Grey-Rock division at Manheim, Penn. Burrows was formerly sales manager of the Industrial Rubber Products division at Passaic, N. J. Gorecki is factory manager of the Manhattan Rubber division. Also promoted by the company was **R. B. Hazard,** sales manager of the Packing division, who was named sales manager—Rubber and Packing.

Drillers put the squeeze on drilling strings, casing, tubing and costs, with the help of nickel alloy steel liners in the Baash-Ross family of slips.

Life of Slip Liners and Fishing Tools Increased by using Nickel Alloy Steel

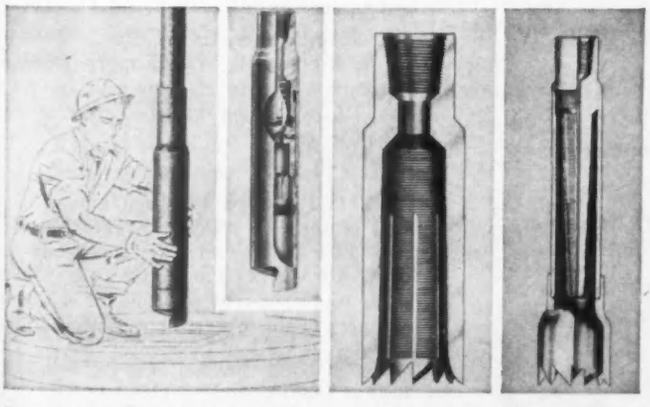
Case Hardened nickel alloy steels provide high surface hardness that resists wear, abrasion and spalling. In addition, the supporting core has ample toughness to withstand severe sudden shocks and overloads encountered by oil well tools.

That's why slip liners and fishing tools developed by Baash-Ross Tool Company of Los Angeles, California, are fabricated from carburized nickel alloy steels.

For slips that give oil men the utmost in dependability, Baash-Ross specifies liners in a nickel steel that resists torsional, tensile and compressive stresses. Resistant as well to abrasion and impact, these liners with their supporting slip bodies come in sizes to fit drill pipe, casing or tubing from 2⅜″ to 20″ in diameter.

Carburized nickel alloy steels play important roles in other Baash-Ross products. Their fishing tap is typical. Basically it is a long tapered thread for insertion into pipe or the like. After taking hold of the "fish", a tap is often jarred to loosen the fish before lifting it from the well. Nickel alloy steel completely meets requirements for a hard, stress-and-shock resistant tap material.

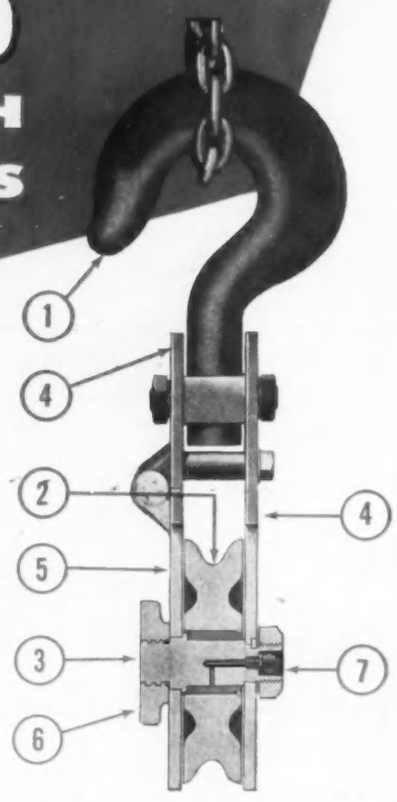
Improvement of specific properties in a steel may be obtained by the use of nickel either alone or in combination with other alloy elements. Accordingly, when you want the best set of properties for meeting your particular needs, investigate nickel alloyed steels. Whatever your metal problem, send us details for our suggestions.



Recovery of parts detached or broken off from a string calls for rotary sockets, die collars or fishing taps such as those shown above. Each combines a hard, wear-resistant surface supported by a tough core. Baash-Ross engineers find Type 4615 nickel-molybdenum steel, case hardened, meets this need. For rotary socket slips, which actually grip the fish, Type 3115 nickel-chromium steel, case hardened, is frequently specified.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

THE Inside Story of WECO SNATCH BLOCKS



These design and construction features are the reasons for the outstanding performance, easy handling, long life and dependability you'll get from WECO Snatch Blocks in a multitude of services.

1. Drop-forged, heat-treated hook has 100,000 lb. capacity.
2. Forged steel sheave is precision machined and accurately gaged, assuring longer life for sheave and rope.
3. Extra heavy sheave pin has "Super Oilite" bearing for smooth-running strength.
4. ⅜" steel plate resists distortion.
5. Drop-Side (patented) is hinged for easier handling and stringing.
6. Wing nut, tightened or loosened with hammer, holds drop-side in place.
7. Zerk fitting for sheave pin lubrication.

25-ton working load capacity; available in 6", 8" or 10" sizes.

PESA

it's wise to standardize with... WECO

WECO®

WELL EQUIPMENT MFG. CORP. • Division of Chiksan Company • HOUSTON 1, TEXAS

Paul Courtney

Robert M. Sherrard

E. B. Schulz

Robert C. Yates

Paul Courtney of Tulsa has been named president and director of the **George E. Failing Company** of Enid, Okla. Courtney succeeds **R. R. Morgan**, general manager of the Cleveland Rock Drill division of Westinghouse Air Brake Company, who has been serving temporarily as president of the Failing Company. Courtney recently resigned as president of Unit Rig and Equipment Company. He has been associated with the oil industry for many years and served in foreign operations with Shell Oil Company. He joined Emsco Manufacturing Company in 1938, later became plant manager of the Emsco plant in Houston and was elected vice president in 1950. He retained this position until 1953, when he joined Unit Rig and Equipment as president and director. The Failing Company is a wholly-owned subsidiary of Westinghouse Air Brake.

Robert M. Sherrard has been appointed district representative at Casper, Wyo., for **U. S. Steel's Oil Well Supply Division.** Sherrard comes to his new post from Olney, Ill., where he served as district merchandise manager since 1951. He joined Oilwell in 1937.

E. B. (Ed) Schulz has been named manager of the new office of **Welex Jet Services, Inc.** in Snyder, Texas. Schulz has been with Welex for more than three years. Prior to his present position, he was sales engineer of the Welex district office in San Angelo.

Robert Calvin (Bob) Yates has been promoted to manager of the Eastern division of **Weatherford Oil Tool Company, Inc.** at Harvey, La. He succeeds **Henry Lee Martin,** now general manager of national sales and distribution for Weatherford at Houston. The division office was moved to Harvey from Nocona, Texas, in the interest of providing better service to its customers in East Texas, Louisiana, Arkansas and Mississippi. Yates, a field man with the company since 1953, moves up from assistant division manager.

Kenneth Davis, Jr.

R. E. Dewhirst

George E. Boudoin

C. R. Olson

Kenneth Davis, Jr. has been elected a director and named president of **Unit Rig & Equipment Company.** He replaces **Paul Courtney,** who has become associated with **Westinghouse Air Brake.** Davis formerly was associated with Loffland Brothers Company in Tulsa as vice president—exploration. Prior to that he was executive vice president of Great Western Drilling Company and Great Western Producers, Inc. both with headquarters at Midland, Texas.

R. E. (Bob) Dewhirst has been appointed sales representative for **Well Equipment Manufacturing Corporation,** and will make his headquarters in Shreveport, La., Dewhirst was with Tide Water Associated Oil Company for four years as a scout and with The National Supply Company in El Dorado, Ark. as sales representative.

George E. Boudoin, former president of U. S. Hoffman Machinery Corporation, has joined **Worthington Corporation** as assistant to the president. Boudoin was associated with U. S. Hoffman Machinery Corporation in various official capacities for 24 years. He became executive vice president in 1947 and served as president from 1952 until his resignation in 1954.

C. R. (Clancy) Olson, sales engineer for **Dowell Incorporated,** has been transferred to the company's new offices in Dallas. Olson formerly was in Dallas. Olson joined Dowell at El Reno, Okla., in 1947 as service engineer, being promoted to sales engineer in 1949. He has served the company in Oklahoma City since 1951.

L. R. Chester has opened a new district sales office for **Maloney-Crawford Tank and Manufacturing Company** in Denver. Chester, who has been with the company for five years, is district manager. He formerly represented Maloney-Crawford at Oklahoma City.

Why
Lightweight
RIDGID
Tristand Pipe Vise 40A
makes your work easier

Extra easy to set up...

built-in folding steel tray pushes up easily to fold legs of Tristand for easy carrying; tray pushes down easily to set up, holds stand solidly rigid.

Handy Work Bench...

extra-strong stand and tray all one unit. Full size vise-base has 3 benders, ceiling brace screw, lots of tool slots, besides handy tool tray. Most for your money—your Supply House has them, can demonstrate and deliver fast!

THE RIDGE TOOL COMPANY • ELYRIA, OHIO, U.S.A.

RIDGID
Work-Saver Pipe Tools

(For more data on advertised products, use Readers' Service blue cards, last page this issue.)

Dow Announces Opening Of New Orleans Office

The Dow Chemical Company has announced the opening of a new field sales office in New Orleans to serve an area including Louisiana, the southern half of Mississippi, southwestern Alabama and northwestern Florida.

The office, located at 925 Common Street, was established as part of a general program to provide improved service for customers in the four-state area. It is under the direction of Glenn H. O'Neal, manager of the company's St. Louis, Mo., office.

This is the third field office opened by Dow in the past 18 months, two others having been set up previously in Minneapolis and Cincinnati. The company now has 15 sales offices in major cities throughout the country.

The New Orleans office has complete teletype service linking the office with all other Dow offices and manufacturing plants in the company's private line system, installed in 1946 to speed up transmission of orders and delivery of products.

The staff will include Louis O. Litherland, Jr., specializing in general chemicals; Richard F. Lee, Dowflake; Albert E. Weil, agricultural chemicals and John J. Sheppard, Jr., office salesman for all products.

Managements of Gardner-Denver And Keller Tool Consolidate

Managements of the Gardner-Denver Company, Quincy, Ill., and of the Keller Tool Company, Grand Haven, Mich., have announced that the stockholders of both companies have approved a consolidation. Keller Tool Comany now becomes the Keller Tool division of Gardner-Denver Company and will continue operations under the former Keller management.

E. V. Erickson, president of Keller Tool Company has been elected an executive vice president of Gardner-Denver Company; Gifford V. Leece remains as president of the Gardner-Denver.

Eaton Licenses Baylor Company To Produce "Elmagco" Devices

The Baylor Company, Inc., of Houston has been licensed by Eaton Manufacturing Company of Cleveland, Ohio, to manufacture and sell electro-magnetic couplings and brakes for oil field drilling equipment. Formerly manufactured by the Dynamatic division of Eaton Manufacturing Company and known as Dynamatic Couplings and Dynamatic Brakes, these devices will now be manufactured under the trade mark of "Elmagco" couplings and "Elmagco" brakes. Sales and service arrangements will remain the same.

Allis-Chalmers to Acquire Assets of Baker Company

The Allis-Chalmers Manufacturing Company and Baker Manufacturing Company have announced that negotiations are underway looking toward acquisitions by Allis-Chalmers of all assets of the Baker Company.

W. A. Roberts, Allis-Chalmers president, and W. C. Staley, Baker president, said that while no disclosure of proposed terms of sale or other financial arrangements could be made at this time, negotiations have proceeded to the point where decisions on final terms should be reached within a few days.

New Bucyrus-Erie Distributor For Northwestern Ontario Named

W. H. Marr Ltd. of Kenora, Ontario, Canada has been appointed Bucyrus-Erie distributor for northwestern Ontario. The new distributor offers sales and service on the Bucyrus-Erie line of three-eighths- to four-yard convertible excavators and cranes (gasoline, diesel, or single-motor electric powered), including the Canadian-built three-quarter-yard. Model 22-B; 2½- to 8-yard Ward Leonard electric shovels; walking draglines with diesel or electric power, and 160-ton and 250-ton railroad cranes. The line also includes the 15-ton and 25-ton transit crane, the truck-mounted, all-hydraulic hydrocrane and hydrohoe, and Red Arch dragline buckets.

Servicing facilities will be maintained at the distributor's plant at 400-418 Railway Street, Kenora, Ontario, and at branches in Atikokan and Dryden, Ontario.

Bethlehem Supply Opens Store at Sweetwater, Texas

Bethlehem Supply Company has opened a new store at Sweetwater, Texas, at 102 McCauley Street. The store will maintain a sufficient stock of drilling and production materials and supplies as required by the increasing oil field activities in Nolan County.

Harry Dodds, field representative, will cover the oil field sales in the area and Vernon Stevens will be chief clerk in the store. The new store will be under the immediate supervision of C. W. Nichols, store manager at Abilene, and under the general supervision of W. E. Stephenson, district manager at Wichita Falls, Texas.

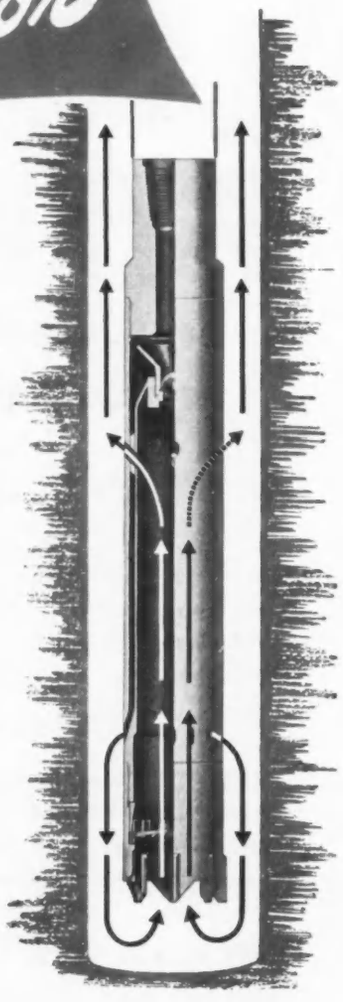
Reverse Circulation

BRINGS IN JUNK!

By reversing normal circulation to literally pull objects into the basket, the BOWEN JUNK BASKET assures complete single-run recovery of all bottom hole junk.

Circulating fluid is diverted through side passages in the barrel and against the full circumference of the hole. Here the fluid is deflected, moving all objects toward center. Fluid flows in a continuous stream to the center of the tool and up through the barrel to return ports pulling all objects through the catcher. This reverse circulation action assures more complete recovery of junk in the hole and eliminates misruns. *Full pump pressure can be utilized* because there's no danger of pressure bearing against and causing loss of the fish.

Comes in sizes from 3¾" to 17½" and is engineered to recover all types of bit cones used to drill hole sizes within its range.



FOR DETAILS
call the Bowen Service Store in your territory or write direct.

Reverse circulation at the bottom of the hole only.

SR BOWEN CO

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EXPORT OFFICE:
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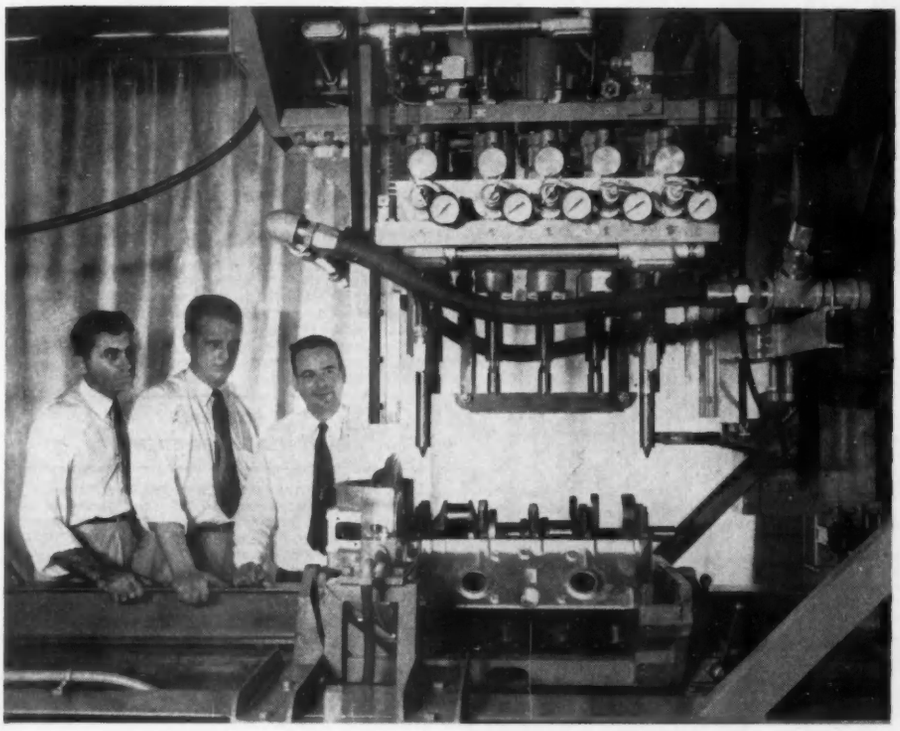
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL R. WITTICH, JR.



COMPLETELY AUTOMATIC, the new ten spindle electro-pneumatic nutsetter was recently developed by Reed Roller Bit Company.

Reed Roller Bit Company Designs New Machine

A machine which will automatically set ten bolts on a V-8 automobile engine cylinder block has been designed, manufactured and delivered to a major automobile manufacturer by the Cleco division of the Reed Roller Bit Company, Houston.

The device, a ten spindle electro-pneumatic nutsetter, is fully automatic and requires no operators. The nut running unit is powered by ten air motors and is self-supported by a steel framework which straddles the assembly line conveyor. With a capacity of 2000 bolts per hour, the machine is a complete unit package requiring only the hooking up of electric and air connections to be put into immediate service.

Engine cylinder blocks are spaced out on the conveyor which never stops during the nutsetting process, as the nut running unit slides on its framework guides at a corresponding pace with the block. As the block reaches the Cleco product, it is centered by fences and rollers, and then triggers the mechanism into motion. The nut running unit lowers and is accurately positioned by pilot pins which fit into holes in the cylinder block. The nut runners, powered by ten air motors, set the bolts, automatically cutting off when stalled at torque.

After the proper time has elapsed, a switch shuts off air to the motors which are bled of air to relieve pressure on the sockets and the overhead cylinder withdraws and returns the unit to the starting position in time for the next cylinder block.

In the initial contact, if the pilot pins don't find the seating holes true, triggers in the pin nose actuate machinery to withdraw the unit from that particular cylinder block. As no manpower is needed to supervise the machinery in operation, if trouble occurs, safety mechanism disengage connections, stop the conveyor and set off an air horn and colored lights to summon help.

50 Companies Take Part In Schlumberger Courses

More than 50 companies served by Schlumberger Well Surveying Corporation were represented at four courses in electrical and radioactivity logging interpretation held in Schlumberger's Rocky Mountain area during the final months of 1954.

Each school lasted four days and covered principles of both electrical and radioactivity logging and problems of interpretation pertinent to the area. The schools were held at Farmington, N. M.; Billings, Mont.; Casper, Wyo.; and Denver.

The schools at Billings and Casper were under the direction of J. L. Heath, Northern Rocky Mountain division manager, and T. A. Morris, assistant manager of the Rocky Mountain area, of Denver. Instructors were R. E. Jones, R. E. Bayles, J. L. Hallman, H. W. Valentine, J. E. Young, Ralph Lloyd, and C. E. Englehart, location managers for Schlumberger in the Northern Rocky Mountain division.

The schools at Farmington and Denver were directed by C. A. Rosenthal, Southern Rocky Mountain division manager, and Morris. Assisting as instructors were Location Managers A. O. Phares, Don Mitchell, J. A. Mullinax, and Wayne Millis.

R. K. Swanson and R. L. Madden, operations department engineers, Houston; C. W. Trainer, manager, Hobbs, N. M. district, and L. G. Chappel, manager, Eastern Canada division, visited each of the schools to lecture on several of Schlumberger's logging and auxiliary services.

Cochrane Corporation Appoints Turbine Equipment Company

Cochrane Corporation, Philadelphia, Penn., announces the appointment of Turbine Equipment Company, of Glen Falls 3, New York, as representative for upper eastern New York State area.

Under this appointment Turbine Equipment Company will handle water conditioning equipment, steam specialties and condensate booster and return systems manufactured by Cochrane Corporation.

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THREAD LUBRICANT AND SEAL

for Casing and Tubing, Drill Collar and Tool Joint Threads

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- full makeup, easy breakout
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- corrosion and rust inhibitor

Contains pure metallic lead and copper flake.

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For applying lubricants faster without hand brushing. Prevents lube contamination. Reduces consumption. Insures clean lube. Saves time, equipment.

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C. L. Cooper, Publisher

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RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. **Minimum** charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted ads,** 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 17th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

FOR SALE

GASOLINE PLANT FOR SALE

Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Adequate storage tanks for all products. Drum Lead Blending Plant. Detailed inventory available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Ft. Worth, Texas

WE BUY, SELL, rent all kinds cable drilling and fishing tools. Largest selections. Send us list of needs. Save money. Thousands of feet of used tubing, casing for sale. New Surplus wire lines. **TRI STATE SUPPLY,** Box 827, Parkersburg, West Va., Phone 7-5121.

■ Failing 1500, truck-mounted drilling rig with 980 feet of 2⅞-inch drill pipe and tools. Also truck with water tanks, all in excellent condition ready to run. Price $12,500.00. Olson Bros. Drilling Co., By Andrew O. Olson, R#1, Arlington, Wash.

HELP WANTED

■ Petroleum Engineer with Master's Degree, or Doctor's in Chemical, Mechanical, or Petroleum Engineering, for research and teaching in Reservoir Mechanics and related fields at rapidly growing southwestern institution. Rank and salary open, twelve months employment possible, consulting work encouraged and available in immediate area. Applications will be kept confidential. Box 53-W, c/o WORLD OIL, Houston, Texas.

■ RESEARCH CHEMIST—Rapidly growing, firmly established sales organization in the Southwest has ideal opportunity for person desiring participation in original research. Require MS in Chemical Engineering with minor in organic chemistry. Experience not necessary. Age 22-30. Applicant must have demonstrated creative ability and capacity for independent research. Work will be with a senior research chemist. Duties will involve synthesis of organic compounds for petroleum production applications and periodic technical assistance of an organic chemical nature. Please write giving personal background, draft or reserve status, salary desired and qualifications to: Box 56-W, c/o WORLD OIL, Houston, Texas.

POSITION WANTED

■ Petroleum Engineer, 38 years old, 9 years with major. Experience in reserve and reservoir performance studies, workovers, drilling, proration and production problems. Desires responsible position with small company or independent as engineer or production man. Box 57-W c/o WORLD OIL, Houston, Texas.

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Petrographic thin sections made from your cores, core chips or sedimentary or metamorphic outcrop samples. Careful attention to individual orders. Quality workmanship. Satisfaction guaranteed. Reasonable prices. Price list on request.

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Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited. Write, wire, or call collect for further information.

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■ Lease, Upton County. Oil 2 miles (or nearer now) 40 acres in S.E. ¼ and S.W. ¼, Block 35, Sec. 93 Miriam Crossett, General Delivery, Atlanta.

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■ WANTED—Producing Oil and Gas Properties O. B. Banks, 1027 San Jacinto Building, Houston, Texas; Phone CApitol 7490.

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For more information on New Equipment and Literature described in this issue, and for data on any advertised products, use the Readers' Service Cards on the last page, just inside the back cover. Circle on the card the code numbers of the items desired and your requests will be forwarded to the manufacturers.

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2 CYLINDER—2 CYCLE HORIZONTAL GAS ENGINES . . .

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TWO CYLINDERS

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  Two power strokes per revolution reduces shock and vibration.
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  Requires less power for starting.
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COMBINES THE ADVANTAGES OF SLOW SPEED FOR RUGGEDNESS AND LONG LIFE WITH THE SMOOTHER POWER DELIVERY OF EXTRA CYLINDERS.

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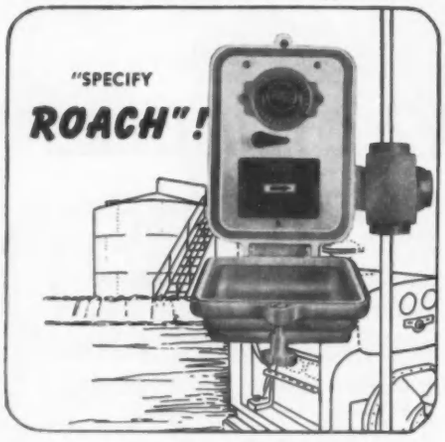

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Don't Need It!

A Tennessee mountaineer up and got married. After he built a cabin for his bride, he brought her over from the next hill to look it over. "Wal, woman, how you like yore home?"

"T'aint bad," she said, "But there ain't no door."

He looked at her in amazement. "Door? Yew plannin' on goin' somewhere?"

•

Grim Fairy Tale

Once upon a time a beautiful girl was walking through the woods when she came upon a poor little frog who spoke, "Lady, once upon a time I was a handsome prince, but a big black witch turned me into a frog."

"Oh, that's too bad," said the beautiful girl. "Is there anything I can do to help you?"

"Yes, indeed," replied the frog. "If you will take me home with you and put me on your pillow I will be saved."

So the beautiful girl took the poor little frog home with her, and the next morning when she awoke, there beside her was a handsome young prince.

And, do you know, to this day her mother still doesn't believe that story.

•

Needs Revitalizing

Discussing the peculiar Texas liquor laws the other day, one fellow remarked that it's just as well that you can't buy a drink in that state, because the modern cocktail served in bars is nothing more than an ice cube which has been given an alcohol rub.

•

Wisdom

"Integrity and wisdom," said the contractor to his new assistant, "are essential to success in the seismic business. By integrity, I mean that when you promise a client something, you must keep that promise, even if we lose money."

"And what is wisdom?" asked the new man.

"Don't make such damn fool promises!"

•

Limousine Service

An airline passenger rushed into the ticket office in San Francisco the other day, clutching his ticket in one hand and his hat in the other:

"Has the limousine for the flight to New York left yet?" he hollered, all out of breath and wringing wet.

The ticket girl took her time about looking up, and replied in her most soothing tone, "No sir, it's just outside the door. Hop in."

The man rushed off. All was serene for a couple of hours. Then who should appear at the counter again but the same passenger, no longer panting, and with a look of resignation written all over his face. "I have just had a two-hour tour of Chinatown," he announced. "What do I do now?"

"I see he's decided to wear his hat now."

Past Performance Tells

All day the weary elevator operator had been patiently answering questions the department store shoppers had thrust upon him. Just before closing time, a voice asked from the rear of the crowded car, "Suppose the elevator cables broke, would we go up or down?"

Unable to compose himself any longer, the operator snapped, "That, my dear lady, depends entirely upon the kind of life you've been leading."

•

Three Little Words

What are the three most beautiful words?

The single young man said that in his estimation, the three words of beauty were, "I love you."

The second man, happily married, argued that "Home, sweet home," took some beating.

The third man won easily—he was a business man and plumped for "Enclosed find cheque."

•

Smug

The fancy dress dance was over and local gossips were comparing notes.

"Mrs. Smithington-Smythe looks upset don't you think?" said one, gloatingly.

"Yes, my dear. She came as a Hawaiian beauty, with grass skirts and all—and they awarded her first prize in the humorous section as 'The Old Thatched Cottage'."

•

Patience

Diner to waiter: "How long have you been working here?"

Waiter: "Just started a week ago, sir."

Diner: "Then you can't be the one who took my order."

SHOT in the right place... ...for best production!

"pin-point" accuracy, uniform hole pattern that gives equal coverage of all the productive zone, PLUS the most important factor of all... deepest penetration, gives you the results you want... MORE OIL!

For Best Results, always specify—

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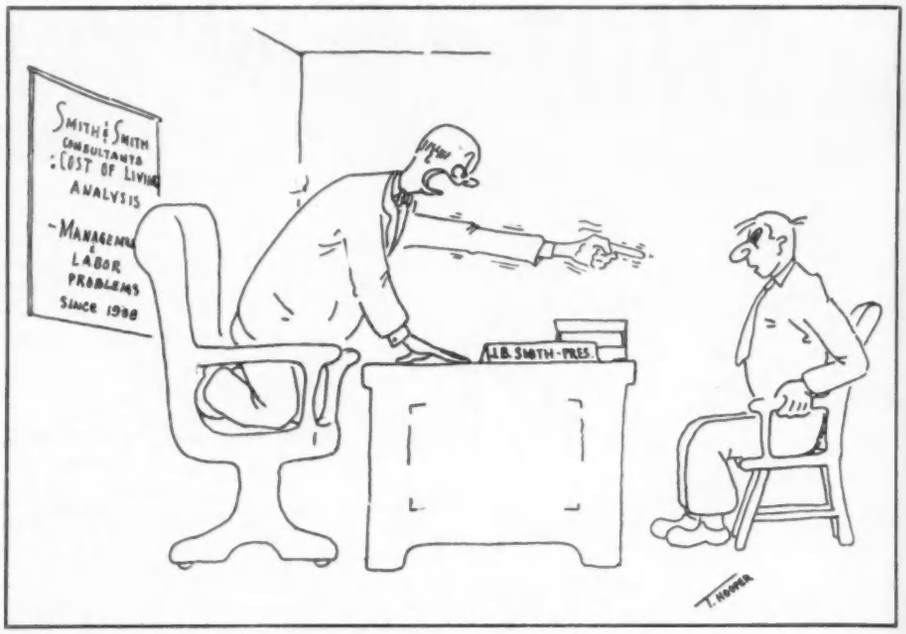

"And what if I do give you a raise—You'll come back for more next year, and the next, and the next . . ."

Capital Service

In Washington, where people have been sharing taxis for years, a young matron, obviously soon to become a mother, hesitated before entering a crowded cab at Union Station.

"Get right in, lady," urged the driver. "We have everything in here but the hot water." She got in, somewhat puzzled, and blushed when she saw that her companions were an army doctor, a navy nurse, and a priest.

•

Safety First

It was dusk when Joe returned to camp from a day's hunting. He met Tom out gathering wood. "All the rest of the boys back?" he asked anxiously. "Yep," replied Tom. "All eight of them, all safe and sound?" persisted Joe. "Yep," said Tom again, "all of 'em, safe and sound. Why?" "Well, in that case," announced Joe with pride, "I've shot a deer."

•

A Record

"For almost 15 years," boasted an elderly man to a group of listeners, "my habits were as regular as clockwork. I got up at a quarter of six, had breakfast at six-fifteen, was working at seven-thirty, had lunch at twelve-thirty, and was in bed at ten sharp."

"My, my," commented a listener sympathetically, "and what were you in for?"

•

A Promotion

"Just imagine!" exclaimed the proud mother. "They've promoted our Tommy for hitting that mean old sergeant. They've made him a court-martial."

GOING FISHING? . . CALL YOUR FRIEND!

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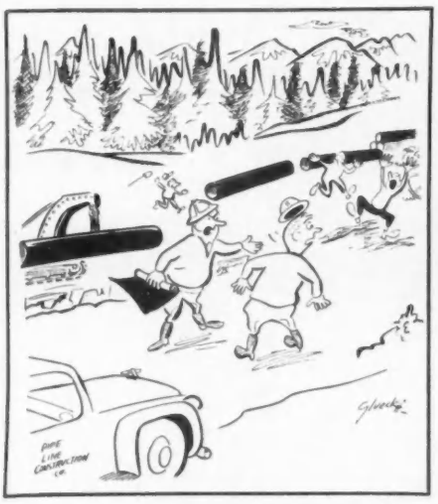
GOTKOOL Water Cooler — made in 2, 3, 5, 8, 10, 15, and 20-gallon sizes with extended or recessed flush-mounted faucet optional. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

GOTKOOL Water Can — made in 1½, 2, 3, 5, 10, and 20-gallon sizes without faucets. Extended or recessed flush-mounted faucets available at slight additional cost. *(Note: 15- and 20-gallon sizes available with extended faucet only.)*

Insist on the genuine — look for the *Blue and Black Label* with the name "GOTKOOL" in Red.

H. P. GOTT MFG. COMPANY
WINFIELD, KANSAS



"We'll have to abandon this stretch and find another route—we've struck uranium!"

Modern Age

Maybe you can blame this on television, but there was the case of the guy who wanted to encourage some musical talent in his children, so he bought them a piano. When he got home they were contemplating the piano in puzzlement.

"How," they asked, "do you plug it in?"

•

Best Bid

"Yes," agreed the consultant, at the bedside of the sick purchasing agent, "I can operate and cure you?"

"What'll it cost?"

"My fee will be five hundred dollars."

"I'm afraid you're going to have to shade that price a bit. I've got a much better bid from my undertaker."

•

Not Lost

Teacher: "Now, Johnny, tell me where elephants are found."

Johnny: "Elephants are such large animals they hardly ever get lost."

•

Definition

Hangover: Something to occupy a head that wasn't used the night before.

•

Warning

"What would you say, Jackie, if I married your mother and became your daddy?"

"Don't do it, Mr. Smith."

•

Threat

A civilian hitchhiker displayed this sign on his suitcase: "If you don't pick me up, I'll vote for him again."

•

Fire Safety

"And what do you do when you hear the fire alarm, my good man?"

"Oh, I jest up and feel the wall, an' if it ain't hot I go back to bed."

•

Special Day

Tramp: "Lady, I'm hungry. Could you give me a piece of cake?"

Lady: "Isn't bread good enough?"

Tramp: "Yes, ma'am, but today's my birthday."

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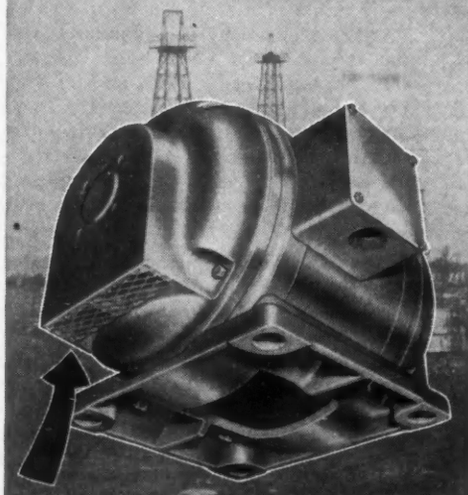
get ALL the facts
and you'll choose
FIELDMASTER
BALL BEARING MOTORS



Like a book, you can't tell a motor by its cover; it's what's **inside** that counts.

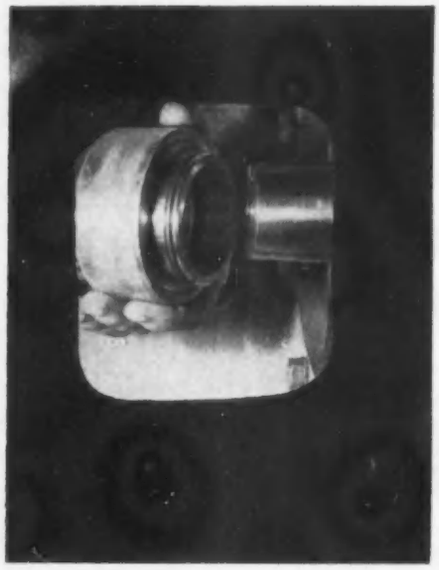
FIELDMASTER Ball Bearing Motors, for example, have been specially designed and built to more than handle the rugged requirements of oil field use. High slip is available to take care of reciprocating load requirements encountered in pumping . . . wide variety of windings provides triple ratings, dual voltages . . . high torque licks heavy starting problems . . . high-grade silicon steel in the magnetic circuit reduces iron losses . . . heavy-duty, double-shielded pre-lubricated bearings increase performance, reduce lubrication problems . . . heavy cast base assures alignment stability.

These are just a few of the many facts which prove FIELDMASTER Ball Bearing Motors are second to none. Our distributor, the Bethlehem Supply Company, will gladly supply you with **ALL** the facts . . . **without obligation.** May we have them contact you?

VALLEY ELECTRIC CORP. 4221 FOREST PARK BLVD., ST. LOUIS, MO.

What's New in Equipment

Drilling • Production • Exploration



Rotary Seal Cartridge

A new rotary mechanical shaft seal in an easily-replaceable cartridge assembly has been announced by Mixing Equipment Co., Inc. This seal has been designed especially for service in fluid mixing applications. It is available in either single or double types, on all models of Lightnin Mixers where shaft sealing is required, and in a variety of materials to suit any fluid mixing conditions. Positive, leakproof sealing of tank liquids, vapors or gases is provided by the new seal. Unlike a packed stuffing box, the seal never requires adjustment while in service. The seal is assembled in a cartridge as a single component. Through a locking collar arrangement it is possible to replace the seal of a mixer that is below the liquid level, or on a pressure vessel without loss of product or pressure.

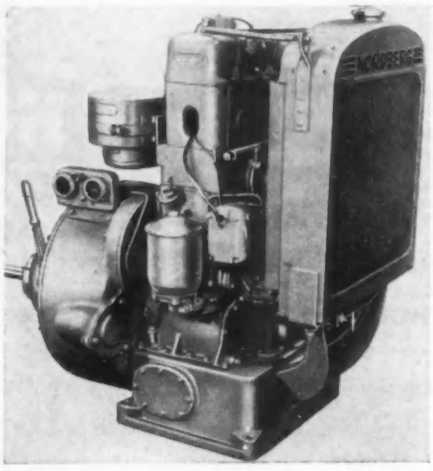
The Lightnin single seal assembly is used in applications where the sealing faces are lubricated by the tank contents, and where service conditions are not severe. The double seal is applied to mixers where the tank contents will not lubricate the sealing faces, where they contain abrasives or under conditions of high temperature or pressure. The seal assembly s available in types suitable for pressures ranging up to 1200 pounds per square inch gage and for temperatures ranging from —120° to +485°. Materials include stainless steel, Stellite, bronze, ceramic, Hastelloy and Teflon.

Special designs also can be provided for other conditions of temperature pressure or other factors. For example when used with the new Lightnin lubricating and cooling system the seal can be used for temperatures up to 1500°F.

Lubrication of the double seal can be by a static system with the lubricant under constant pressure by a circulating system with a constant differential between lubricant pressure and tank pressure.

(This item supplements Mixing Equipment Co. data on pages 3290-3291 of the Composite Catalog 20th Edition.)

For more data circle **No. E1** on Readers' Service Card, last page this issue.

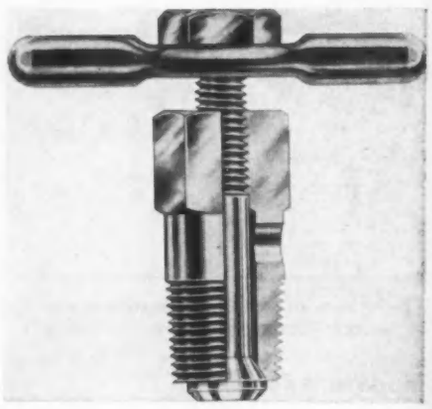


Gas Engine

Addition of a new one-cylinder gas engine to its Power Chief series of small diesel prime movers is announced by Nordberg Manufacturing Company. The Power Chief gas engine is built as a low cost, medium-speed unit for oil field service as well as for any small power application where natural gas is advantageously available.

This new Nordberg engine is rated at from 9 to 18 maximum brake horsepower within an operating speed range of 800 to 1800 revolutions per minute. It has a 4½-inch bore and a 5¼-inch stroke and is an extra heavy duty, vertical, spark ignition four-cycle engine. Currently produced only in the single cylinder model, it is available as a complete, self-contained, ready-to-operate power unit with clutch power take-off and as a "packaged" generator set producing up to 10 kilowatts. Major parts of Power Chief gas and diesel engines are identical, permitting conversion of one to the other at reasonable cost.

For more data circle **No. E2** on Readers' Service Card, last page this issue.



Bleeder Valve

The new stainless steel GRALOC vent-drain-bleeder valve manufactured by Gray Tool Company in sizes one-half inch and three-fourths inch has been designed for 20,000 pounds per square inch safe working pressure or temperatures up to 1200° F.

A pressure-aided seat makes it leakproof for oil, water, gas or steam service. It is fabricated from a combination of types 410 and 416 stainless steel, making it suitable for essentially any fluid or atmosphere, and providing a maximum resistance to galling.

It may be used for vents and drains at the high and low points of piping, equipment and instruments, to bleed at double block valves, and as freeze drains, trycocks and sample connections.

(This item supplements Gray Tool Company data on pages 1901-1936 of the Composite Catalog, 20th Edition.)

For more data circle **No. E3** on Readers' Service Card, last page this issue.

Wire Ropes

A new line of wire ropes, with steel cores, having 15 percent greater strength than the strongest grade marketed heretofore, is announced by John A. Roebling's Sons Corporation. The new rope has higher resistance to wear from bending and abrasion.

This new rope will be manufactured primarily in preformed constructions and will be an aid to manufacturers of drilling and excavating equipment. It will allow the handling of heavier loads for longer periods, as well as the drilling of deeper wells. Because of its general ruggedness, it will also last longer in logging operations.

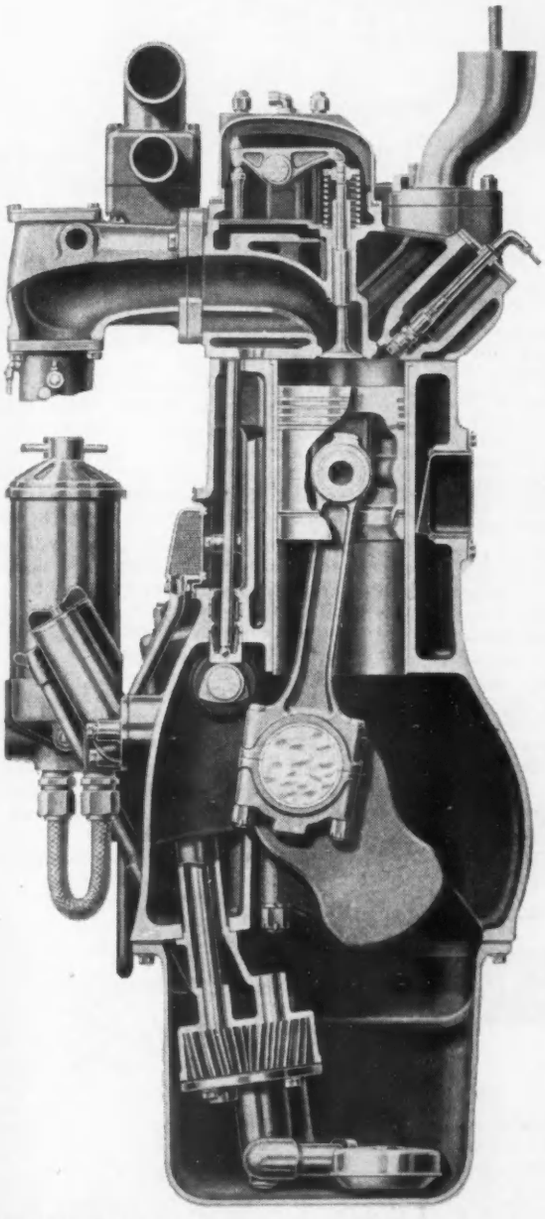
The higher strength rope will be obtainable in rope sizes ranging from one-fourth-inch to 3½ inches. The new ropes can be used on shovels, draglines, wagon-scrapers and all earth-moving equipment, rotary rigs, etc.

For more data circle **No. E4** on Readers' Service Card, last page this issue.

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.

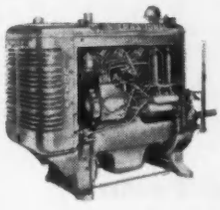
12 Solutions to Your Pumping Problems

Insist on INTERNATIONAL as original equipment on your pumps; they're tops for power as replacements, too!



HERE ARE SOME of the many outstanding features of this INTERNATIONAL U-1091 natural gas engine: seven-bearing counterbalanced crankshaft, torsional vibration damper, aluminum-alloy pistons, tin-plated for scuff resistance, replaceable cylinder sleeves, intake and exhaust manifolds on opposite sides for free flow of air and gas into engine and unrestricted outflow of exhaust gases, stellite inserts on exhaust valve seats, and full-pressure lubrication.

INTERNATIONAL 4-CYLINDER OIL FIELD ENGINES



INTERNATIONAL U-264 engine is next to the largest in the 4-cylinder line with 264 cu. in. displacement and 29-52 horsepower range on the pumps.

SPECIFICATIONS

	DISP.	MAX. TORQUE @ RPM	RPM SPEED RANGE	HP RANGE
U-1	59.5	38@1700	1500-2500	8 to 16
U-2A	113	82@1200	1200-1800	15 to 24
U-164	164	124@1000	1000-1800	18 to 36
U-264	264	197@ 900	900-1600	29 to 52
U-9	334.5	229@ 950	900-1500	31 to 55

INTERNATIONAL 6-CYLINDER OIL FIELD ENGINES

INTERNATIONAL U-282 is one of seven new IH 6-cylinder oil field engines that have shown pumpers everywhere how to cut maintenance and operating costs.

SPECIFICATIONS

	DISP.	MAX. TORQUE @ RPM	RPM SPEED RANGE	HP RANGE
U-220	220.5	151@1200	1200-2400	30-62
U-240	240	166@1200	1200-2400	34-64
U-282	282.5	204@1225	1200-2400	41-75
U-372	372	263@1200	1200-2200	54-91
U-406	405.9	279@1200	1200-2200	56-98
U-450	450	324@1200	1200-2200	66-110
U-1091	1091.6	823@ 800	900-1600	136-200

An example of the sturdy construction of INTERNATIONAL *oil field engines is seen in the cutaway front sectional view of the new U-1091.*

The growing tendency to standardize on stand-out performers is adding to the reputation of INTERNATIONAL pumping engines throughout the oil fields.

The INTERNATIONAL line includes 12 models of 4-and-6-cylinder oil field engines, ranging from 38.5 to 823 lbs. ft. maximum torque—from 8 to 200 net horsepower.

If you need a full measure of honest power, IH is the line for the most exacting applications. Whether you need original equipment or replacement power, check with your INTERNATIONAL Industrial Power Unit Distributor or Dealer and discover how INTERNATIONALS can do your work better and for less money.

INTERNATIONAL HARVESTER COMPANY, CHICAGO 1, ILLINOIS

INTERNATIONAL
INDUSTRIAL POWER

MAKES EVERY LOAD A PAYLOAD

INTERNATIONAL HARVESTER

DRILLING

Casing Hanger

The Burns Tool Company announces a new casing hanger which eliminates casing overlap, thus saving miles of pipe. This patented casing hanger suspends pipe in perfect alignment and its slip design has no drag springs.

Casing hangers built by Burns suspend loads with safety. It is possible to suspend the oil string in tension and it will not collapse of its own weight. Neither will it buckle or shift position in the well, sink into the bottom formation or bend into cavities. The hazards of casing contacting the wall of the hole are eliminated. A perfect aligned casing is not subject to undue wear from servicing tools. Also successful cementing is assured as no time is lost in making up overlapped casing or making up extra surface circulating connections.

The secret of the Burns casing hanger rests on the slips. Instead of the conventional tapered cone used to force slips outward, the Burns patented construction provides specially broached single plane runners on which slips travel with a full 100 percent backup contact at all positions. Burns casing hangers reduce well-completion costs and are now available in all popular sizes.

For more data circle No. E5 on Readers' Service Card, last page this issue.

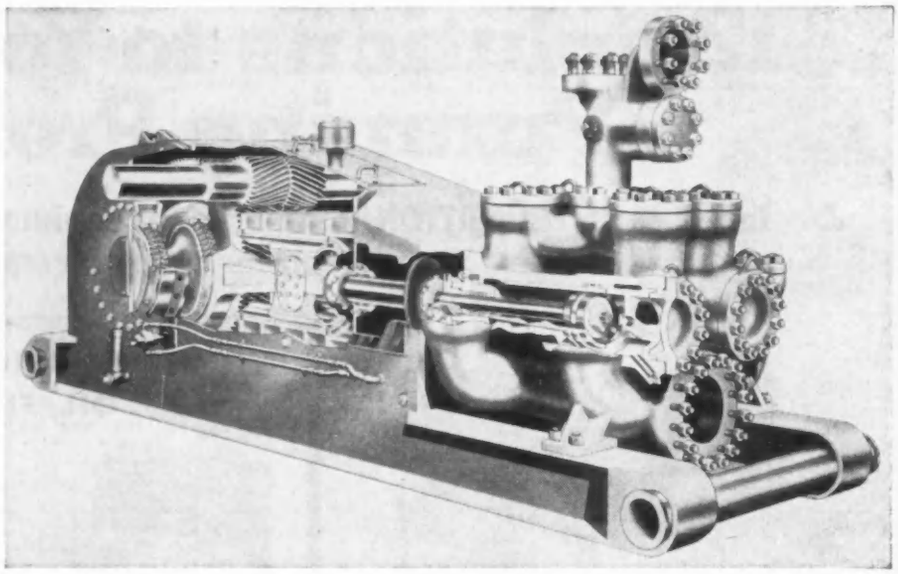
Traveling Blocks

Two new traveling blocks have been added to the Brewster drilling equipment line. Built in 400 and 500 ton capacities, the new blocks meet the extra duty requirements of today's deeper wells. Available with five or six sheaves, they can be specified with sheave diameters and grooving to match all heavy duty mast and derrick crown blocks.

The new traveling blocks retain the straight fall characteristics and design features of the Brewster traveling block line. Sheaves are mounted on Timkin tapered bearings assuring positive alignment and easy turning under heaviest loads. The high capacity center pin is of heat-treated alloy steel and has been rifle drilled to assure an abundant supply of lubricant to individual sheave bearings.

(This item supplements The Brewster Company, Inc. data on pages 825-860 of the Composite Catalog, 20th Edition.)

For more data circle No. E6 on Readers' Service Card, last page this issue.



Slush Pump

The new IDECO 600-horsepower duplex 7¼ by 16 slush pump now available is specifically designed for the higher plunger loads required in modern jet drilling. All-steel construction makes possible a high horsepower to weight ratio for ease in handling and setting up and holds moving costs to a minimum. With expendables, less sheave, the Mudmaster weighs only 30,150 pounds.

Extra-wide 16-inch-face herringbone gears permit low unit pressure on gear teeth. Large 21-inch outside diameter double-tapered main and connecting rod bearings are interchangeable. All radial clearances in the tapered roller bearings, races and carrier elements have been removed to minimize impact loadings and eliminate bearing slap. High-strength "crankcentric" crankshaft and connecting rods are one-piece heat-treated steel castings.

The high-pressure Mudmaster fluid end is a normalized one-piece steel casting hydrostatically tested to 6000 pounds per square inch. Smoother, fully-streamlined passage contours, a sloped suction manifold, and large valve areas result in high volumetric efficiency.

Important weight reduction while increasing strength and rigidity has been accomplished by integrating skids and frame into an all-steel "Fabriform" assembly, stress-relieved before machining. Repairs to the steel fluid end and other steel components can be made in the field.

Power and fluid ends have separate and independent lubrication systems. A positive supply of oil at all operational speeds is provided in the power end by a simplified gravity system which directs a cascade of lubricant to all moving parts. Forced-feed lubrication from a rotary oil pump is delivered to all sides of the fluid piston rods at the point of wear through a screw-type packing gland.

(This item supplements IDECO, Division of Dresser Equipment Company, data on pages 2429-2488-A-B-C-D of the Composite Catalog, 20th Edition.)

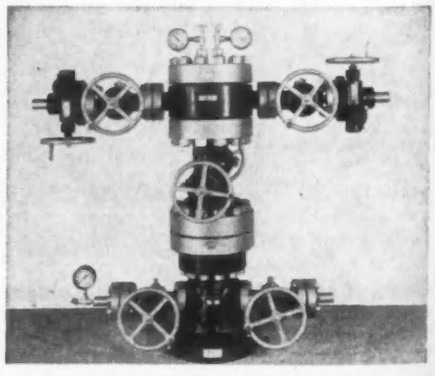
For more data circle No. E7 on Readers' Service Card, last page this issue.

PRODUCTION

Dual Christmas Tree

Oil Center Tool Company is producing a dual christmas tree for use in dual well completions which provides a substantial saving in drilling and equipment costs. The dual assembly includes such features as a special hanging and sealing flange on top of the tubing head and steel-to-steel seals throughout the assembly through the use of Flex-Float steel rings. Standard API ring joints are also used as a seal from the atmosphere.

The dual tree provides full opening throughout into both strings for swabbing, paraffin cutting, running pressure bombs, storm chokes, pumping, flowing or for gas lifting. The two tubing strings are hung independently and may be run into the well or pulled from the well independently.



The dual tree is more effective in producing through two strings of tubing than producing through the casing annulus. With the use of packers, the casing may be loaded to prevent corrosion. It is possible with the dual tree to flow from three separate zones by using the two strings of tubing and the annulus should a triple completion be indicated. Dual completion

Save time! Keep informed! Circle numbers on Readers' Service Cards, last page this issue.

Wilson Supply Co.,—HEADQUARTERS FOR

WILSON-SNYDER PUMPS

PARTS and SERVICE

Wilson-Snyder Pumps are stocked at Wilson Supply Company Stores in Houston, Shreveport, Harvey, Houma, Alice and Corpus Christi, with emergency stand-by parts carried at all Stores.

The large, new warehouse in Houston serves as the central headquarters for stocks of both Pumps and expendable Parts.

(In the Gulf Coast and Northern Louisiana)

The complete line of Wilson-Snyder Power Pumps is designed to meet every kind of mud circulating requirement with maximum economy and dependability. Rugged, powerful, and with a reputation of dependability as old as the drilling industry—Wilson-Snyder Pumps are "leaders in the field."

A size "W-S" Pump for your Every Mud Circulating and general Service Requirement

SLUSH PUMPS

818-P	220-P	218-P	214-P	212-P
925 HP	600 HP	500 HP	325 HP	220 HP
	612-P	510-P	8 P-HD	
	140 HP	116 HP	85 HP	

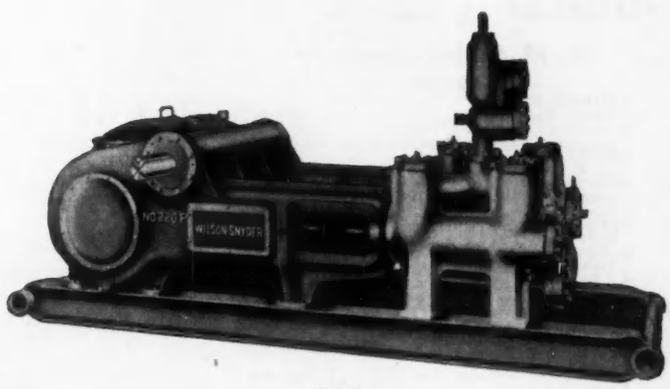
GENERAL SERVICE PUMPS

6 P-HD	6 P-LD	510-P	8 P-HD	610-P

SPECIAL SERVICE TRIPLEX

324-P	334-P	344-P	326-P	36-P
	46-P	358-P	48-P-HD	

from 45 HP to 445 HP
from 790 to 17,450 bbls. per day.



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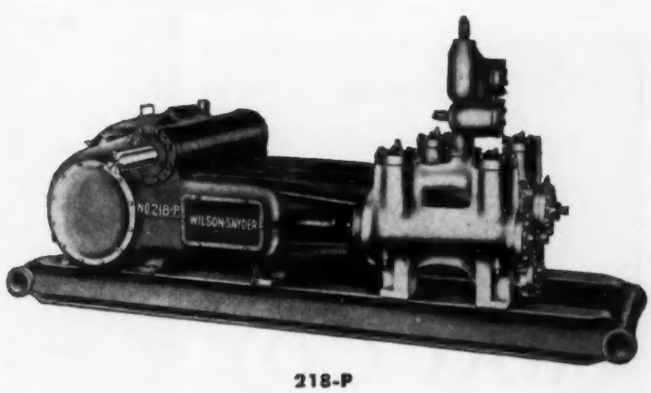

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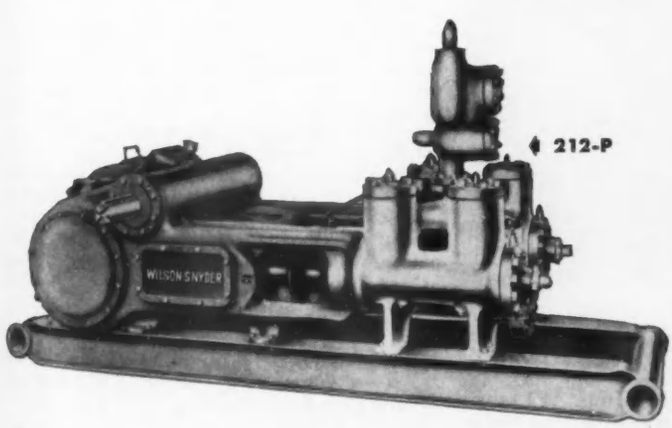

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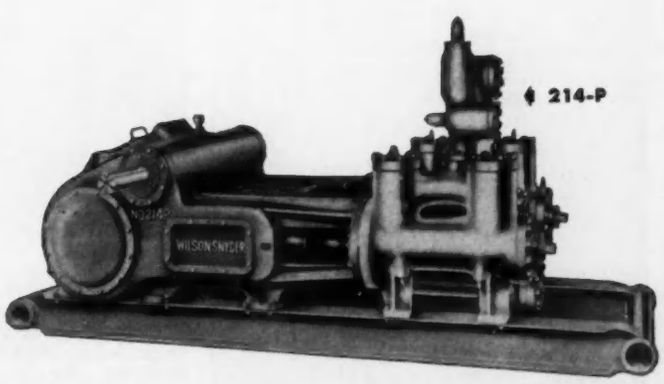

214-P

WILSON SUPPLY COMPANY

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5-1958
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7728
NEW IBERIA, LA.
2-8165
2-9878
HOBBS, N. M.
3-5059

with the dual tree allows the operator to produce two zones simultaneously with one well taking the place of two.

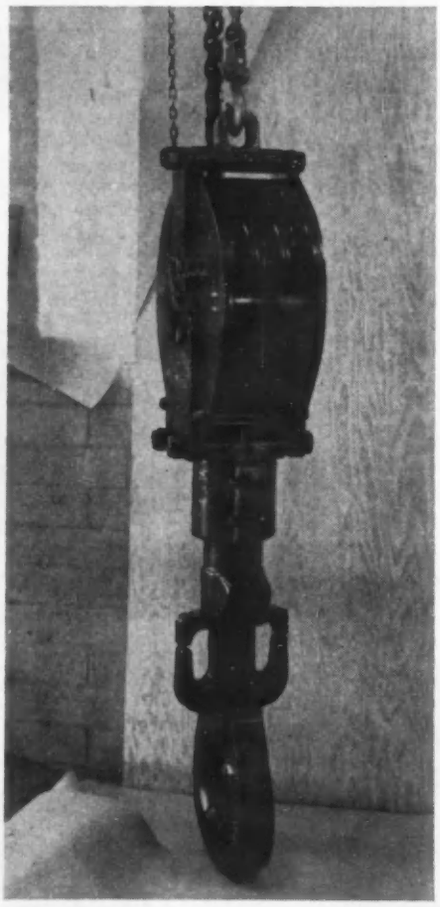
(This item supplements Oil Center Tool Company data on pages 3689-3720 of the Composite Catalog, 20th Edition.)

For more data circle **No. E8** on Readers' Service Card, last page this issue.

Tubing Blocks

A new line of 65 ton tubing blocks, designated Type D, is now in production by The Guiberson Corporation. Built short and compact, these tubing blocks fall fast and will not foul up. Sheave bearing are heavy duty cylindrical roller bearings and hook bearings are heavy duty tapered roller thrust bearings.

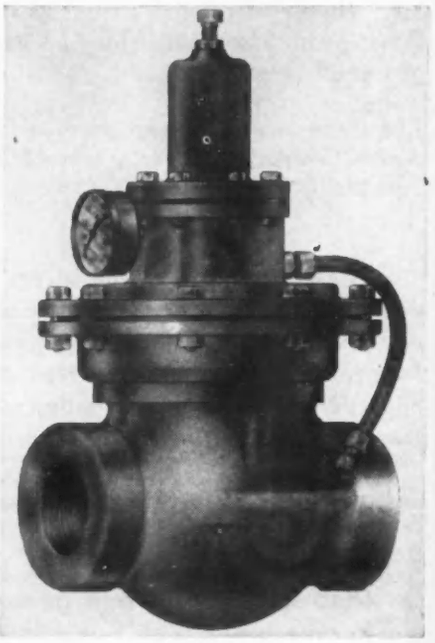
The blocks are available with double or triple 24-inch sheaves grooved for three-fourths, seven-eighths or one-inch line and may be obtained with spring hook, spring duplex hook or spring triplex hook. The hook swivels freely or locks in any one



of eight positions and is especially engineered for space saving and safety. With a factor of safety three to one on yield point, all blocks are well within API specifications. This line of 65 ton tubing blocks supplements the line of 40 ton Type D single and double 18-inch sheave tubing blocks with swivel becket recently announced by Guiberson.

(This item supplements The Guiberson Corporation data on pages 2069-2196 of the Composite Catalog, 20th Edition.)

For more data circle **No. E9** on Readers' Service Card, last page this issue.



Back Pressure Regulator

Black, Sivalls & Bryson, Inc., has introduced the new Type 73-22 back pressure regulator with integral controller for services where close regulation and complete closure are required in a single instrument. Designed for optimum control on low pressure oil separators, water knockouts, gunbarrels, gas gathering lines and other equipment requiring close pressure control as well as tight shutoff, the BS&B back pressure regulator works equally well, within its pressure limitations, in all gas or air services that require back pressure regulation.

The integral controller has a wide range of adjustment. Construction features include a hi-tensile cast iron valve body, spring housing and diaphragm casings; pressure transmission tube; pilot operating mechanism machined from stainless steel and aluminum; Buna-N valve diaphragm with no center punching; nylon reinforced Buna-N soft seat insert; spring loaded Teflon packing; stainless steel valve stem; valve seat machined into valve body. It is available in two-inch screwed globe, three-inch and four-inch flanged globe sizes. The control range is 5 to 125 pounds; and temperature range is up to 165°F.

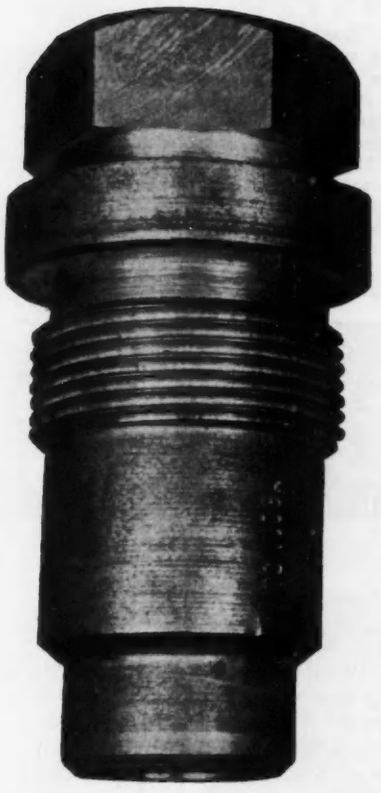
(This item supplements Black, Sivalls & Bryson, Inc., data on pages 657-696 of the Composite Catalog, 20th Edition.)

For more data circle **No. E10** on Readers' Service Card, last page this issue.

Circle numbers on Readers' Service Cards, last page this issue.

This stem seat of plain carbon steel, removed from an Adjustable Wing Valve after only 45 days of service on a gas-condensate well, graphically illustrates the seriousness of corrosion.

After 7 years of continuous service on the same well, this stem seat of UNIBOLT "SA" Stainless Steel shows little, if any, harmful effect of the gas-condensate corrosion.



If CORROSION is your problem

UNIBOLT "SA" Stainless Steel Christmas Tree Fittings may provide the answer. For the past seven years, in cooperation with a major oil company, UNIBOLT engineers have experimented with various stainless alloys to determine the one most resistant to gas-condensate corrosion. The un-retouched photographs above of identical parts tested on the same well clearly indicate the wisdom of selecting UNIBOLT "SA" Stainless Steel Fittings for corrosive conditions.

UNIBOLT "SA" STAINLESS*

THORNHILL CRAVER CO.

P. O. BOX 1184 HOUSTON, TEXAS

* Special Analysis, Special Heat-treatment

New Catalogs and Equipment Literature

Oil Production Study

Second National Bank of Houston has recently released a study on the production history of the 18 principal oil producing formations in Arkansas, Louisiana, Mississippi, New Mexico and Texas.

Statistics include name of the field, county, year of discovery, area proved acres; production to end of 1952, wells producing December, 1952; gravity, API; character of formation, porosity percent; average net production thickness in feet. Using this data, recovery in barrels per acre and barrels per acre foot were calculated for each field.

To get a copy, circle **No. E11** on Readers' Service Card, last page this issue.

Hoist Bulletin

An eight-page bulletin describing the company's complete line of spur-gear hoists is ready for distribution by Coffing Hoist Company. Including pictures, cut-away drawings, descriptions and specifications of the entire YC and YCT lines, the bulletin describes a total of 62 different sizes and models with capacities from one-fourth to 25 tons. In addition to standard single and multiple-chain units, models for specialized applications are shown.

To get a copy, circle **No. E12** on Readers' Service Card, last page this issue.

ROBINSON OLDEST NAME IN ORIFICE FITTINGS

Type E For Low Pressure . . .

2" to 30" A.G.A. Spec.

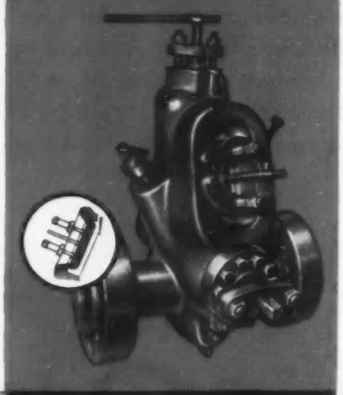
Where, except at Robinson, can you obtain all these features in an orifice fitting for gas or liquid flow? Extreme accuracy of measurement is yours because the Robinson orifice is always centered with the piping and sealed against leakage. Orifice plates can be changed safely and quickly (3 to 5 minutes) with no interruption in flow, no hazards or gas loss. Various sizes and pressure ranges up to 3,600 PSI, flanged or welding neck.

Type E For High Pressure . . .

2" to 6" Pipe Size A.G.A. Spec.

Same fine metering characteristics as the standard low pressure Type E shown above, but built for 6,000 PSI with positive pressure seal which becomes tighter as the pressure increases. Safety is assured because the fitting cannot be opened until the pressure is released. Available in flanged or welding neck. Compare Robinson point-by-point and you'll choose Robinson.

SEND FOR ROBINSON CATALOG NO. 54.

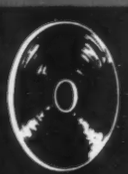


ROBINSON ORIFICE FITTING COMPANY

2830 LUGO STREET • LOS ANGELES 23, CALIF.

ORIFICE PLATES AND HOLDERS

Standardize on Robinson orifice plates regardless of the make of fittings on your lines. Robinson plates conform rigidly to A.G.A. requirements. Our 30 year reputation for building accurate orifice plates is protection you can count upon.



Equipment Booklet

Black, Sivalls & Bryson, Inc., has released a new catalog on vertical separators. In addition to perspective, cutaway and dimensional drawings for low, intermediate and high pressure sizes, the booklet features a section of graphs giving gas capacity of each separator through its operating pressure range. The graphs compensate for oil gravities of 35, 45, 55, and 65 degrees API and cover a gas specific gravity range of 0.6 to 0.9.

To get a copy, circle **No. E13** on Readers' Service Card, last page this issue.

Master Engineering Manual

Publication of a new master engineering manual on Multi-V-Drives has been announced by Worthington Corporation. The manual presents a scientific and simplified method for rating V-belts.

Each 60-cycle motor speed with drive selections is shown. A table on drive selections contains stock sheave combinations and each belt column in the table section is complete with series of arc and length correction factors.

The use of a graph to find effective diameters eliminates the De factor for sheave diameter and ratio and saves on multiplication steps. Service factors for proper duty classification are based on load requirements and hours of service, eliminating the general practice of guessing the service factor applicable to the various classes.

In addition to accepted theories on V-drive engineering, such factors as small diameter sheaves, centrifugal force, average hours per day operation and other conditions affecting belt life are included.

To get a copy, circle **No. E14** on Readers' Service Card, last page this issue.

Cyclone Designs

A 12-page catalog illustrating four basic model cyclones for desanding oil well drilling muds is available from Equipment Engineers, Inc. It describes new features of moulded pure gum replaceable lining and integral two-stage cylindrical design. The catalog contains data on the role of cyclones in classification and presents details of specific applications of each model with various objectives.

To get a copy, circle **No. E15** on Readers' Service Card, last page this issue.

Rockwell-Built *MUDWONDER* Stopped Standpipe Valve Sanding-Up on Falcon Seaboard Rig No. 29

"Our 4 in. MUDWONDER has more than paid for itself with savings in down-time and parts on these last four wells," says Toolpusher E. A. (Blackie) Blackwell, "and it is still working perfectly—holding pressure as well as the day we put it on."

In the Anse Le Bute and Church Point fields where the Falcon-Seaboard Drilling Company Rig No. 29 has been working, sand is often quite a problem. According to "Blackie" de-sanding the standpipe valve at least once every hole and replacing parts was a necessary and costly practice until he bought a MUDWONDER for the standpipe.

Now "four holes" old, the MUDWONDER has required no maintenance and still works easily and positively. Even if it should need a part replacement in the near future, the job can be done quickly and easily. The one-piece MUDWONDER body stays in the line and only one wrench is needed to remove the bonnet.

Is it any wonder that "Blackie" and his crew are convinced MUDWONDER mud valves are best?

On standpipes, jet guns, pump discharges, whatever your troublesome service is you will cut costly down-time and part replacements with competitively-priced MUDWONDER mudline valves. Ask your favorite supplier or use the coupon below for complete details, today.

Edward Valves, Inc.
Subsidiary of
ROCKWELL MANUFACTURING COMPANY
1214 West 145th Street
EAST CHICAGO, INDIANA

Send me your latest MUDWONDER catalog and price list for 3000 psi WP (6000 psi test) and 2000 psi WP (4000 psi test) mudline valves.

Name_____

Company_____ Title_____

Address_____

City_____ Zone_____ State_____

New Books, Maps and Movies

CUBA PETROLEUM NEWS DIGEST, Clarence W. Moore, Editor and Publisher, and Earl Copeland, Jr., Associate Editor, Edificio Habana 910-912, Calle Habana 258, Havana, Cuba.

This is a biweekly report on current oil activities in Cuba. Information of interest to the oil industry is boiled down and summarized on all phases of petroleum exploration. Cuba Petroleum News Digest is similar to oil reporting services available in the U. S. Significant events are reviewed, drilling activity is reported, who and what various interests are doing is factually presented, maps of interest are published, and general petroleum news is carried. This is the only service of its kind available in Cuba.

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THE QUARTERLY OF THE COLORADO SCHOOL OF MINES, Volume 49, Number 4, Department of Publications, Colorado School of Mines, Golden, Colo. $2.

A more comprehensive approach to the study of the physical and chemical properties of hydrocarbons, the principal constituents of crude oils, is presented in the latest Quarterly. Written by George W. LeMaire, associate professor of petroleum refining engineering, the publication is based on extensive research at the graduate level supervised by LeMaire and others. Aims of this work were to determine and correlate the properties of pure hydrocarbons with those of petroleum fractions, in order to better understand the characteristics of the raw materials with which the petroleum refining engineer is concerned. Sections of the quarterly are aniline point, flash point, blending viscosities and pour point.

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NUCLEAR GEOLOGY, A SYMPOSIUM OF NUCLEAR PHENOMENA IN THE EARTH SCIENCES, Henry Faul, editor, John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. $7.

This new book covers questions of theory, methods and latest developments, coordinated and arranged by the editor. The group of writers represented in the book reflects the current state of research and discovery going on in the laboratories and study centers engaged in this work. After Marble's historical introduction, these scientists deal with fundamental considerations, instruments and techniques of detection and measurement; uranium and thorium; the abundance of potassium; rare gases and fission in nature; heat from radioactivity; radiation damage and energy storage; hydrocarbons formed by the effects of radioactivity and their role in the origin of petroleum; geophysical exploration by nuclear methods; determination of absolute age; and the origin of the earth.

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TAXATION OF OIL AND GAS INCOME, Clark W. Breeding and A. Gordon Burton, Prentice-Hall, Inc., 70 Fifth Avenue, New York, 1954.

This is a practical guide in solving the daily tax problems of oil and gas production. Complete with explanations of I.R.C. changes, this book shows how to minimize the tax consequences of every transaction from the conveyance of property rights—through joint operation set-ups—to the sale of gas and oil at the wellhead.

This book sets forth principles in the field of income taxation that control transactions common to the oil and gas producer. It is not possible for economic or political concepts to be applied with mathematical exactitude; nevertheless, the concepts and practices discussed will provide a guide to the person who plans the transactions of oil and gas producers, so that the tax impact can be predicted with reasonable certainty. Although the book is primarily concerned with operations of the industry in the U. S., one chapter has been devoted to the corresponding tax concepts applicable to practice in Canada.

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PRICE MAKING AND PRICE BEHAVIOR IN THE PETROLEUM INDUSTRY, Petroleum Monograph Series, Volume 1, Ralph Cassady, Jr., New Haven: Yale University Press, 1954. London: Geoffrey Cumberlege, Oxford University Press. $4.

In this detailed study of the dynamics of competition, made with the full cooperation of the oil industry, the author exposes the actual techniques of business rivalry. He analyzes the nature of competition, the economic principles underlying competitive behavior, and the complex factors determining pricing at crude, refinery, tank wagon and retail levels. He shows how individual companies operate in the attempt to wrest business away from one another, how opponents are chosen, how a price war is waged, and what legal problems enter into a system of competitive arrangements. This volume is published under the auspices of the Editorial Board of the Petroleum Monograph Series, established by a grant from the American Petroleum Institute.

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OIL SLANGUAGE, Jerry Robertson, Petroleum Publishers, Evansville 8, Ind. $3.65.

This is a new and interesting book describing the lusty language of rugged men who dig deep and dangerous holes and who sometimes find oil and the fortunes which power modern America. The book has 198 illustrations and seven charts and contains explanations of the terms and slang of the oil fields, mostly from the mechanical side of oil. There is a series of "Done in Oil" stories dealing with bits of history and tales of the oil country.

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1954 PETROLUEM REVIEW, Gaines County, Texas, Robert L. Phifer, Phifer Petroleum Publications, P. O. Box 20,024 Houston, Texas. $10.

This new publication, similar to an earlier review of Andrews County, Texas, is the most complete reference book available on another of West Texas' oil producing counties. The book contains information on 18 years of oil and gas production from 49 fields—Seminole (San Andres) of 1936 to Amrow (Devonian) of 1954. It includes discovery wells, logs and structure maps, and production record, including the first six months of 1954.

CARBON-BAKELITE
PISTON RINGS
.. HIGHEST EFFICIENCY
WITH LEAST WEAR!
For your gas compressors, you need a highly effective, low friction material not affected by wet or sour gases.
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